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CONTENTS

Wages, Profits, Prices. By Enders M. Voorhees	15
Low Priced Car Economics. By Leonard Westrate	17
Registration as a Source of Essential Motor Vehicle Facts. By Malcolm McEachin	20
How the Controllable Pitch Propeller Increases Personal Airplane Utility. By Peter Altman	22
Parish Again Producing Passenger Car Frames. By Joseph Geschel	26
Airbriefs. By Robert McLarren	29
Bond Testing of Silver-Plated Engine Bearings. By Frank D. Hallworth	30
Extreme Economy in Small French Car. By W. F. Bradley	34
Salt Bath for Heat Treating Stabilized Stainless Steel By Keith Whitcomb	36
Observations. By Joseph Geschel	40
News of the Industry	42
Calendar of Coming Events	48
New Production and Plant Equipment	50
New Products	56
New Products for Aircraft	72
Advertisers' Index	174

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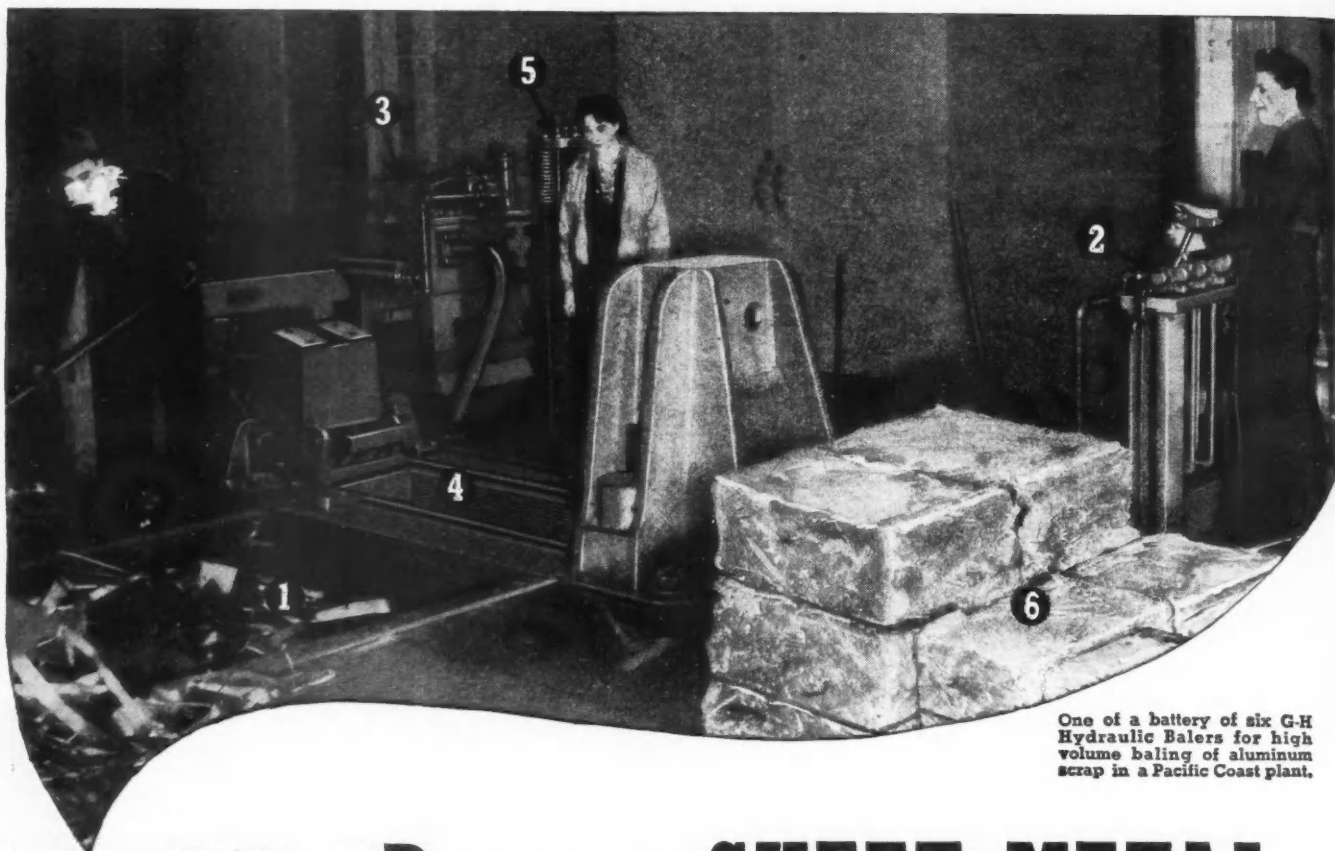
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Wages, Profits, Prices

By Enders M. Voorhees

Chairman, Finance Committee, U. S. Steel Corp.

BY A curious sort of not too honest presentation, a portion of the public has been made to believe—or perhaps it would be more accurate to say “pretends to believe”—that wages in large industry can be advanced without limit and without effect on price. The theory presupposes that corporate profits constitute a bottomless well endlessly to be dipped into. Just for purposes of rough comparison, it might be noted that the entirety of corporate dividends in the United States in 1939 amounted to \$3.8 billion and that the maximum amount in any year since then has only been \$4.5 billion. These amounts—about the size of the approved British loan—constitute the sole incentive for our entire incorporated business. They represent the comparatively small cost to America of having enormously productive and highly efficient tools of production—tools for unparalleled abundance in peacetime and impregnable defense in wartime. The expectation of earning wages for tools—dividends for owners—is the only peacetime reason for creating jobs and payrolls.

Dividends from manufacturing have averaged in the past four years about 7½ per cent of manufacturing wages and salaries—that is, the wages and salaries were about fifteen times the dividends. Since 1939 there has been a 70 per cent increase in wages. It is obvious that this great wage increase could not have been paid out of dividends—if you try to get a 70 per cent wage increase out of a 7 per cent margin what you really do is to abolish the reason for paying wages. The wartime wage increases were met by the repetitive production of identical specialty items and by the fabrication of many other war specialties. In peacetime we must meet the varying specifications of a multitude of customers—an entirely different cost situation.

There is one curious thing about the theory or notion that wages in large industry can be advanced without limit. It is that the theory or notion is never extended to the small filling station or the corner store or, for that matter, to any business operation that individuals can see for themselves.

The real and basic problem can be simply stated. It is: How can our historic system of producing and exchanging goods and services recover from the acute indigestion brought on by the increase in the whole cost—for all manufacturing industries—of a wage earner's hour of approximately 70 per cent since 1939?

The elemental fact is that the increased costs—many of which as yet have not been felt in full—can be met in one or more of only three ways. We have no widow's cruet out of which to pour wages.

First, there is volume. There is no magic in volume. If we can double the volume of a business, the unit cost will be reduced to some extent. If we assume that 25 per cent of the cost is fixed and that the volume of production is doubled, the unit cost theoretically would go down by 12½ per cent. But 12½ per cent is a long way off from the approximately 70 per cent increase in

(Turn to page 62, please)



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Low Priced Car Economics

By Leonard Westrate

Charts Included with This Article Show Price and Physical Changes of "Big Three" and Models Available in Various Price Groups

FOR all practical purposes, there is no low-priced regular sized automobile today. Admitting that the term "low-priced" may be a matter of relativity or definition, it still is obvious that what was considered the low-price field before the war now is uninhabited. Then any of the Big Three—Ford, Chevrolet, and Plymouth—could be delivered to the buyer, ready to drive away from the salesroom for considerably under a thousand dollars. Now the buyer has to put down a minimum of about \$1100 and in most cases it runs considerably more than that. Even the Crosley, which is not a full-sized car and is not generally considered as a competitor of the Big Three, has a retail list price of \$749, which means that when taxes, transportation, and other charges are added the delivered price will not be far from \$850.

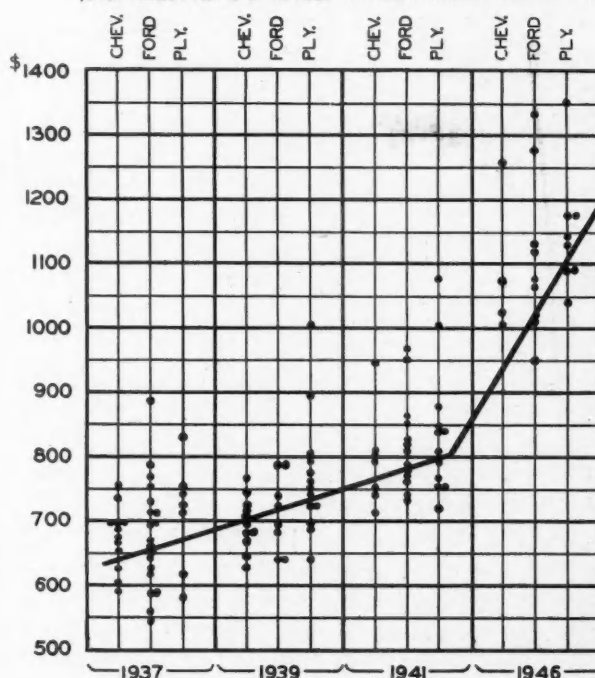
The situation is not fully explained by saying that present higher prices in the former low-price field are the result of increased materials cost and increased wage rates. These factors, of course, have been greatly instrumental in jacking prices up much higher than they were before the war. They have also supplemented a trend that developed in the last few years before the war. In 1939, for example, the lowest delivered price for a Chevrolet, 5-passenger, 4-door sedan was \$689. It rose in '40, '41, and '42 to \$740, \$795, and \$907 respectively. Ford and Plymouth models showed about the same trend in price increases. Prices for the same or comparable 1946 models, in approximate figures, are Ford, \$1150; Chevrolet, \$1075; and Plymouth, \$1215. It should be remembered in connection with

these 1946 prices that they represent the price near the factory and with no extra equipment, and do not by any means indicate prevailing average prices. In addition, if present dealer discount absorption of about 8 per cent were knocked out of OPA regulations, as now seems pretty certain, prices possibly would go up another \$80 to \$100 on these cars.

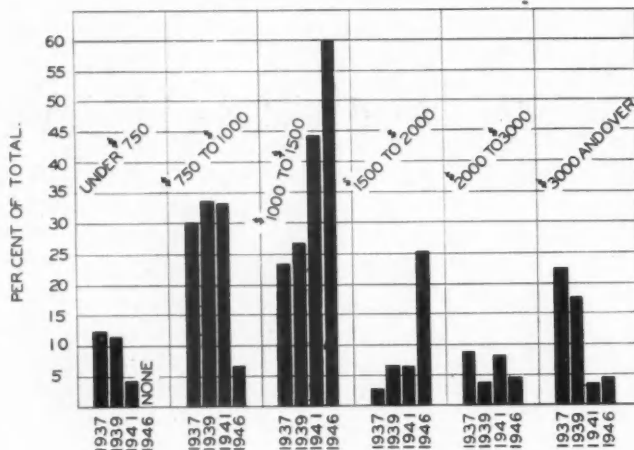
In addition to the obvious conclusion that car prices would rise coming out of a depression, automobile manufacturers are aware of other factors which lead to higher prices. The simple fact is that in the past few years automobiles have been embellished, enlarged, made heavier and more powerful, and generally fancied and tricked out in plush accoutrements until they no

DELIVERED PRICES AT FACTORY OF CHEVROLET, FORD AND PLYMOUTH CARS.

1946 PRICES ARE AS OF MAY 22. PRICES INCLUDE FEDERAL TAX.



NEW PASSENGER CARS BY PRICE CLASSIFICATIONS
EXCLUSIVE OF FEDERAL TAXES
BASED ON NUMBER OF MODELS OFFERED

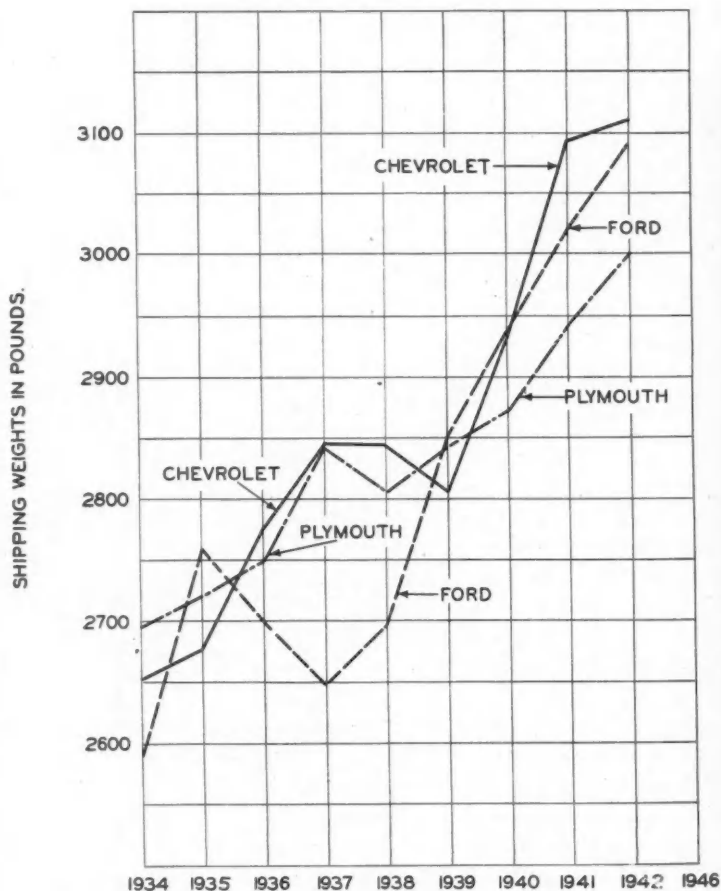


lion. However, Ford figures that in 1941, assuming the average income of this group to be \$2250, the price of the Ford two-door model represented, for each purchaser in this group, approximately 38.5 per cent of his income. In 1946, the price of the same model represents about 50 per cent of total income. In addition, with the sharp rise in income tax rates since 1941 and the greatly increased cost of necessities since 1941, the net buying power of this group now is lower than it was then. With current prospects indicating possible further increases in car prices, it is obvious that nearly 25 million families with incomes under \$3000 do not represent the lush market potential they did before the war. This appears to be borne out by the experience of one large dealer in Detroit. He reports that his company, one of the Big Three, compiles reports showing the type of

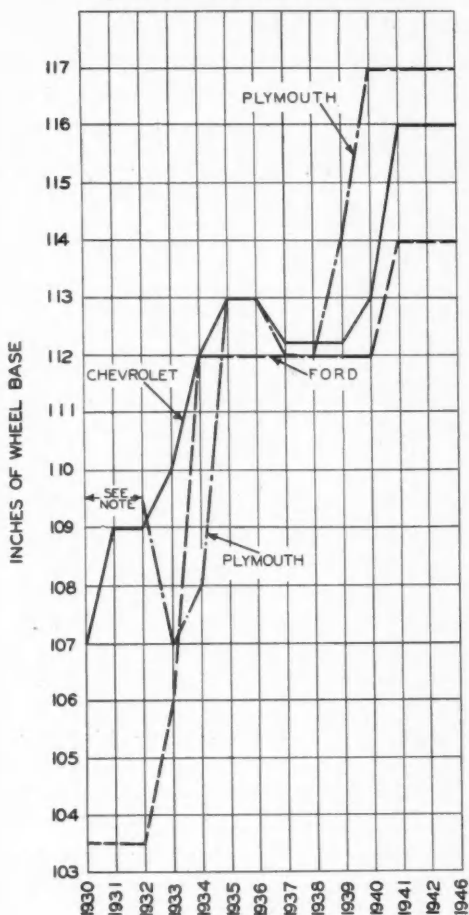
longer bear any resemblance to the rather simple and unpretentious cars of a decade or more ago. This is not to say that improvements were not in order, for to do so would be to refute the experience of the industry, and question its policy which has always been to build as good a car as possible at the lowest possible cost.

The economics influencing a decision to engineer and produce a new design to meet the demand for a car within the reach of millions of American families have been thoroughly surveyed by the manufacturers. Big companies do not plan the expenditure of millions of dollars for engineering development, new plants, equipment, and tooling on the mere hunch that the market may be there for the product. Exhaustive studies have convinced them that past and pending price increases for automobiles have placed the former low-priced car beyond the reach of a large segment of the market. Statistics show that in 1941, about 37 per cent of all new cars purchased were bought by families with income of less than \$3000 and that 65 per cent of the low-priced cars sold that year were purchased by this same group. Before the war, there were about 11 million families in the \$1500 to \$3000 per year income classification, now there are about 13 mil-

SHIPPING WEIGHTS OF LOWEST PRICED CHEVROLET, FORD AND PLYMOUTH 5-PASS. 4-DOOR SEDANS. (1937-1940 FORD V85 WAS TAKEN IN PLACE OF V60.)



CHANGES IN CHEVROLET, FORD AND PLYMOUTH WHEELBASES 1930-1946



NOTE:—FOR 1930 AND 1931 PLYMOUTH ONLY GAVE OVERALL LENGTHS WHICH WERE 169IN. FOR 1930 AND 167IN FOR 1931.

purchaser now buying new cars. The report shows an overwhelming preponderance of sales to executives, professional people, and businessmen, with only a small part going to factory employees. The dealer says that before the war he sold a large proportion of cars to factory employees, but that to date he has not made a single sale to a factory worker. Both he and the company are worried over that situation.

Another factor influencing introduction of a lower-priced new car is the absence of a normal used car market. Buyers who in normal times would turn to a used car for transportation no longer can do so because of the limited supply brought about by cessation of production of new cars for nearly four years. Automobiles now comprising the used car market are at least four years old and most of them are much older. The average age of cars in the used car market is probably slightly over nine years. Many should have been scrapped long ago. As a result, the used car market will be sketchy for a long time yet, and probably will not get back to the prewar rate of turnover for two or three years at least. In addition, the

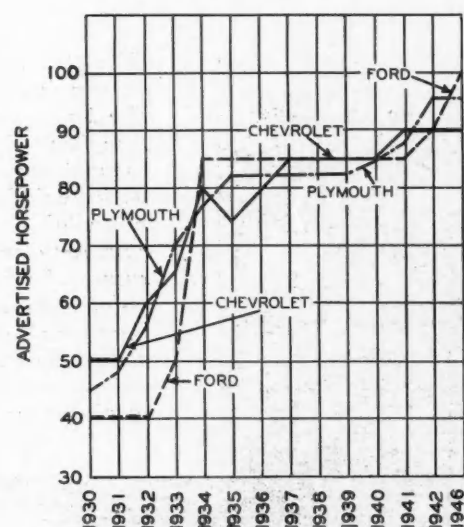
large backlog of demand for new cars and production prospects over the next year or two do not auger well for channeling turned-in 1945 and '46 models into the used car field in any appreciable quantity. Consequently, if new lightweight cars are available at a price anywhere near that of a good used car, buyers may turn in that direction.

Other considerations that may be influencing introduction of a lower-priced line are the advantage of having a greater price range to offer and the value of having in production a car that will sell in case of a recession, when more expensive models might not be down-priced fast enough to avoid a slump. Another possibility that has been mentioned is the possible extension of such a model to the foreign field, where lighter weight and lower horsepower are in vogue. Economy of operation, which would be a natural corollary of these two factors, should be an inviting prospect to both foreign and domestic users.

Both Ford and Chevrolet previously added lower-priced models to supplement their regular lines. In 1933 Chevrolet introduced a Standard model which sold for about \$60 under the Master line. It had a three-inch shorter wheelbase, 20 less hp, smaller tires and was generally less well appointed. Difficulty was experienced in building up its sales, for in 1936 production of the Master model still was about 50 per cent higher than the Standard model. In 1937 Chevrolet replaced the two cars with a new model. Ford introduced the 60 hp model in 1937. This car weighed about 200 lb less than the regular model, developed 25 less hp, and sold at approximately \$31 under the regular Ford line. Its sales were low. No one is quite certain why these cars did not attract more buyers. The general opinion, however, is that even though they were priced under the regular models, the price

(Turn to page 96, please)

CHANGE IN HORSEPOWER OF CHEVROLET, FORD AND PLYMOUTH ENGINES 1930-1946



Registration as a Source of

CONSIDERING the size and importance of highway commerce, it is remarkable how little is known about it. It would seem to the layman that each State should know at least how many trucks of various capacities are licensed to operate on its highways, and perhaps would have found it desirable to compile certain facts about those trucks—such as their body types, the businesses in which they are engaged, their annual mileages of operation, the type of fuel they use, their year models, etc. Some States do compile one or more of these items, but those that do are exceptions, and insofar as we know, none can supply all of them.

Such information on trucks and busses—the rolling stock of highway transport—is needed by both public bodies and the transportation industry, and under proper conditions it could be obtained in the regular registration process. Disregarding for the moment the difficulties of establishing a “good” registration system, let us consider what should be expected of such a system.

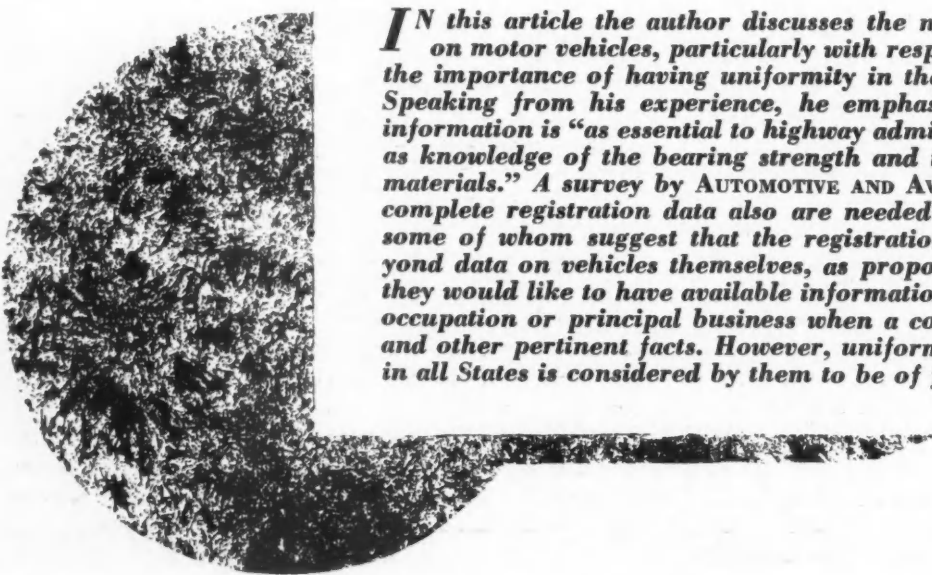
1. It should accurately and efficiently collect the taxes that have been established by the Legislature.
2. It should provide a quick and certain means of identification, both for prevention of theft and for establishing liability if necessary.
3. It should assure conformity of the vehicle and its use to existing legislation, and should supply size and weight data useful to the State in determining equitable tax schedules.
4. It should give data essential for the proper design of highways.
5. It should yield some information on the magnitude and

nature of highway commerce—particularly the industries concerned and, if possible, the mileage of operation.

6. It should give industry a reasonable amount of noncompetitive information on the vehicles in use, the amount they are used, and the taxes paid on them.

The registration systems of most States are designed primarily to collect taxes, and to serve as identification for police and regulatory purposes. With few exceptions, the registration authorities are either not interested in going beyond this minimum, or lack the power and means to do so.

It is odd, but not inconsistent with our past history as a nation, that we have spent so much on building highways without knowing more about the service they perform, or who they serve. It was not until the late Thirties that a nation-wide effort was made to obtain essential facts concerning highways and their use. Nearly every State, in cooperation with the Public Roads Administration (then the Bureau of Public Roads), began a highway planning survey to obtain the facts necessary for long-range highway planning. These were begun during 1936 in most States, and later in others. The object was to determine the physical condition of existing highway facilities; for what, by whom, and the extent to which they were used; and to learn how they were supported. These facts were to be established in order to determine present and future need for highways, to plan them efficiently, build them economically, and spread the costs equitably. The study of motor vehicles was an important feature of these investigations.



I**N this article the author discusses the need for more registration data on motor vehicles, particularly with respect to commercial vehicles, and the importance of having uniformity in the records of the various States. Speaking from his experience, he emphasizes that adequate registration information is “as essential to highway administration and highway planning as knowledge of the bearing strength and the physical properties of road materials.” A survey by AUTOMOTIVE AND AVIATION INDUSTRIES discloses that complete registration data also are needed by automobile manufacturers, some of whom suggest that the registration information be extended beyond data on vehicles themselves, as proposed in this article. If possible, they would like to have available information on the purchaser, such as his occupation or principal business when a commercial vehicle is concerned, and other pertinent facts. However, uniformity of registration information in all States is considered by them to be of first importance.**

f Essential Motor Vehicle Facts

By Malcolm McEachin

President, American Association
of Motor Vehicle Administrators,
and Commissioner, Nevada
Motor Vehicle Department

The highway planning surveys were the first large-scale Federal-State cooperative approach to the problem of determining present and future highway needs and making long-range plans to meet those needs. There were three phases to these surveys: The physical inventory of highways, the analysis of highway costs and who paid them, and the study of traffic. Included with the analysis of highway costs, but closely related to physical inventory and traffic, was the problem of finding out who used the highways, how much, and what for. This information is every bit as essential to highway administration and highway planning as knowledge of the bearing strength and physical properties of road materials. Any person who doubts this should be taken on a tour of the roads and bridges that were built too narrow, the curves that are too sharp, and the intersections that are too dangerous, built in past years without proper planning and vision.

Those who question the cost of obtaining an adequate knowledge of motor vehicles—what they are, where they are, and what they do—should reflect on the fact that a large part of the highway facilities built in past years are already obsolete. Many roads and bridges that are still in good physical condition are utterly inadequate for modern traffic. Not long ago a bridge 20 feet wide on some of our main highways was deemed adequate to meet the demands of growing volume of highway traffic for many years to come. Today a 20-foot bridge on a main highway not only constitutes a bottleneck, but in addition it is a serious accident hazard at speeds which, today, are considered very moderate. With a better knowledge of vehicles and their operation, we should be able to avoid such mistakes in the future. The savings in life, in time, and in property, achieved through proper highway planning make that planning not only desirable but absolutely necessary.

The registration records of the States, in general, give the name and address of the owner, make and year model, and the weight and fee paid. The general

registration class is known, e.g., automobile, taxi, truck not for hire, truck for hire, etc. Some States have excellent records on trucks for hire, but in others the classifications are so broad that they are of limited value.

One of the major faults is the inclusion of vehicles of widely varying characteristics in the same registration class. In several States, busses are registered as trucks. In others, they are registered as passenger cars, and even in the States that do segregate busses, many do not make any distinction between private and public ownership and between common-carrier and school busses. Taxicabs, depending on the State in which they are registered, may be included with private automobiles or with busses. In Illinois they are registered with trucks. Semi-trailers are registered as separate units in some States but as part of a truck-trailer-semi-trailer combination in others. Some trailers are registered as trucks in Maine and Oregon. In Vermont trucks under 1500 pounds capacity are included with automobiles. These are but a few examples of the lack of uniformity in vehicle classifications; there are many more.

On the other hand, the State registration units in many instances pick up information that is of little or no value. Possibly the most common examples of this are the requirements of some States for reporting solid tires, which are practically non-existent now, and for reporting serial number in addition to motor number. Serial number may be used on occasion to identify a vehicle for taxing purposes, but as a rule it is not so used; or is it feasible to locate a vehicle by knowing its serial number. Most motor vehicle departments list each registration in three ways:

(Turn to page 130, please)

How the Controllable

THE personal airplane business can only grow at the same rate as it increases its utility. There are many factors which contribute to airplane utility, but the out-

standing ones are: (a) more airports suitable for personal aircraft, (b) improved performance for better cross-country operations, (c) improved comfort and visibility and (d) lower operating costs. These factors, although they are quite different in their apparent functions, upon closer study it can be seen that they bear a rather close dependence upon each other. It will be shown by this presentation that the use of a controllable pitch propeller plays an important part in each of these factors and consequently, results in better overall utility for the personal airplane.

The controllable pitch propeller is not a new development. Its advantages have been known for both aircraft and marine application for many years and the importance of its use has been recognized for some time. For the larger commercial and personal airplanes as well as for the military airplane it has found practically universal application and has well demonstrated that the extra cost and weight has been far outweighed by the improved performance of the airplane. The application of controllable pitch propellers

By Peter Altman

Engineering Consultant

to the smaller personal airplane has been slow because until recently there was little demand for high performance airplanes

of this type. Most of these airplanes were used for training and short operations close to the home airport. Very few regular cross-country flights were made. Consequently, the necessary take-off and climb performance could easily be obtained by the use of low wing loadings and relatively high power loadings. The low density of operation at airports and the availability of sufficiently large airports also favored this design. Added to these conditions is the fact that reliable controllable pitch propellers at a reasonable price were not available and prior to the war none of the established manufacturers could see sufficient production volume to warrant the expenditure to develop a suitable one for the personal airplane.

However, these conditions have now changed considerably and the increased demand for the number of personal airplanes of high utility suitable for cross-country operations almost makes the controllable pitch

propeller a "Must" if the demand for the personal airplane is to continue to grow at a rate to support the expanding facilities of this new business. Continuous attention must be given to the fact that the airplane is essentially an inter-city vehicle and as such, to attain utility, it must have good take-off, climb and cruising performance, all of which can be materially improved through the use of a controllable pitch propeller.

Several types of controllable pitch propellers are now available for the personal airplane. Some are operated hydraulically, either by stationary or rotating hydraulic actuators, others are operated mechanically by manual or electric controls. All types can be made to provide constant speed operation, two position or multiple blade position operation. Each has its distinct advantages, which have to be determined from the spe-

Here is a view of the all-metal, four-passenger Navion airplane powered with a 185 hp continental engine.



Pitch Propeller

Increases Personal Airplane Utility

cific installation and the results desired. For simplicity many may desire the simple two position type to provide one position for take-off and climb and the other for normal level flight operation. For those who desire the ultimate in performance, there is the constant speed type which will cost more and require more attention from the pilot to obtain the optimum performance. It will be necessary to co-ordinate engine speed with manifold pressure as well as to give atten-

tion to other factors, whereas in a two-position propeller in which the two pitch positions are pre-selected by the manufacturer to give the best compromise performance, the pilot is only required to operate the control about the same as he operates the throttle. For the average pilot this type of operation has many advantages.

The technical details of how the controllable pitch propeller improves performance can best be studied by means of a few simple formulas and charts. A few of these will be discussed.

Take-Off and Climb

With a fixed pitch propeller, the ground engine speed may be from 15 to 20 per cent less than the engine speed in level flight, both taken at wide open throttle. The exact figure depends upon the type of propeller used and whether it is of the thin metal or wood type. In an engine whose rated speed is 2600 rpm, this means a loss of 390 to 520 rpm (see Fig 1). For an engine of 85 hp (Fig. 1), this results in a loss in available power at take-off of 13 to 19 hp, with a

resulting increase in the take-off run. Calculations for a typical modern personal airplane of relatively high performance shows that with the controllable pitch propeller the take-off distance is reduced 19 per cent. This is accomplished by decreasing the pitch of the propeller and permitting the engine to run at its rated speed and, consequently, make available the added power for take-off. In the case of the fixed pitch propeller the engine operates at point B (69 hp) and with the controllable at point A (85 hp). At point A, 16 hp additional horsepower is available over that at B for the fixed pitch propeller and this is used to decrease the take-off run.

The take-off run can be expressed as

$$S_o = \frac{K_1 W V^2}{T_1} \quad (\text{Ref. 1 and 2}) \quad \text{where}$$

S_o = Take-off run in zero wind.

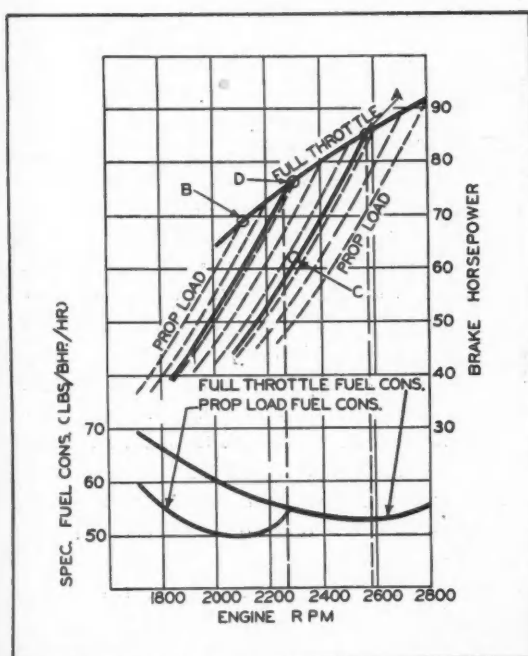
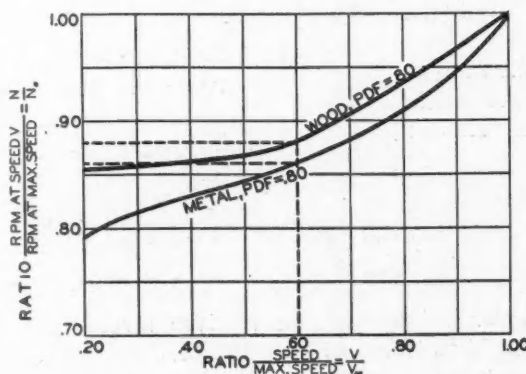


Fig. 1 — Typical power chart—full throttle, propeller load and fuel consumption curves.

Fig. 2—Variation of rpm with speed V (mph)—fixed pitch propellers.



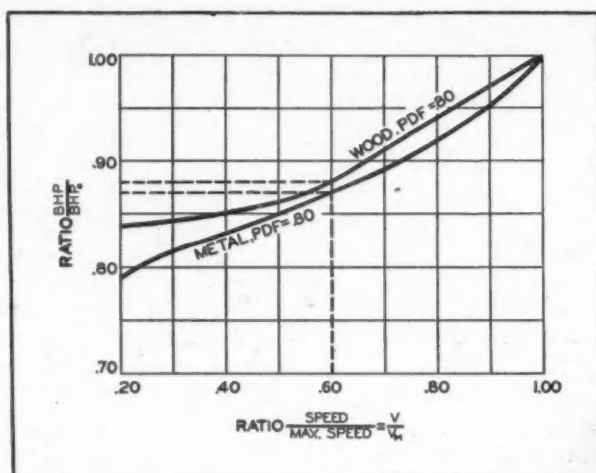
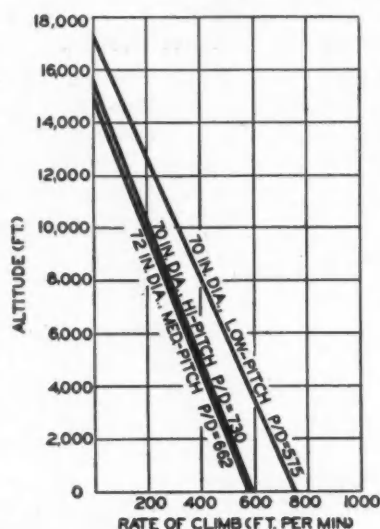


Fig. 3—Variation of bhp with speed V (mph)—fixed pitch propellers.

Fig. 4—Rate of climb—fixed pitch and controllable pitch propellers.



K_s = Coefficient depending on the ratio of final net thrust to initial net thrust.
 V = Take-off speed in ft./sec.
 T_1 = Initial net thrust in lb.
 W = Gross weight of airplane at take-off.

Since K_s and T_1 are dependent upon the power delivered by the engine to the propeller, any increase in available power at this point decreases the take-off run. The fact that the initial net thrust T_1 is in the denominator makes this value important as a means of providing increased acceleration during the initial part of the take-off run.

If small differences between propeller blade designs can be neglected, the take-off run can be expressed in terms more readily available to the operator as follows:

$$S_o = K \left(\frac{W}{S} \right) \left(\frac{W}{P} \right), \text{ (Ref. 3)}$$

K = 2.7 for controllable propellers.
 = 3.3 for fixed pitch propellers.

W/S = wing loading.

W/P = power loading at rated power.

This formula shows an 18 per cent decrease in take-off run for the controllable pitch propeller, but it should only be considered as an average value because the exact value depends upon the propeller-engine-airplane combination. Airplanes of high performance will show a better improvement, as high as 30 per

cent, and those of low level flight performance will show less improvement, as low as 10 per cent, because the ground speed of the fixed pitch propeller varies with the maximum speed of the airplane and the pitch diameter (P/D) ratio of the propeller. If the engine has a take-off power rating which is higher than the normal rating, then there is additional improvement.

Climb

In the climbing condition with a fixed pitch propeller, the propeller speed at full throttle is also less than in level flight at the same throttle position. If we assume that the best rate of climb occurs at an airspeed of about 60 per cent of the maximum speed it can be seen from Fig. 2 that for the average personal airplane type engine that the propeller speed would be decreased 12 per cent for the average wood propeller and 14 per cent for the average metal propeller. This results in a decrease in the power available of 12 per cent for the wood propeller and 13 per cent for the metal (Fig. 3). Consequently, the rate of climb is decreased.

With the controllable pitch propeller, the total normal or take-off power can be made available in the climb with the resulting increase in the rate of climb.

The rate of climb for a typical personal airplane of average performance is shown in Fig. 4 for sea level and at different altitudes for the fixed pitch and controllable pitch propeller. At sea level the controllable pitch propeller shows an increase of 160 ft/min or 27 per cent in the rate of climb.

The rate of climb can be expressed by the formula:-
 (Ref. 1)

$$C_o = 33000 \left[\frac{K_2 \eta_{max}}{(W/P)} - \frac{V_c}{375 (L/D)} \right]$$

where

C_o = Initial rate of climb in ft/min.

W/P = Power loading based on normal power.

η_{max} = Max. propeller efficiency.

V_c = Airspeed in climb (mph).

L/D = Overall ratio of lift to drag at climbing speed
 (Approximately equal to max. L/D .)

K_2 = Ratio of power available at climbing speed to power available at maximum speed.

For a given airplane the value of the right hand side of the bracket is nearly constant when changing from a fixed pitch propeller to a controllable pitch propeller. Consequently, any increase in the left hand value will increase the rate of climb. The factor K_2 is the determining factor and depends upon the power

available in the climb, and since the controllable pitch propeller makes the full rated or take-off power available in the climb, K_2 will be a maximum and the rate of climb is increased.

This formula expresses the difference in power available and power required at climbing speed. The same conditions are also shown in Fig. 5, which is a typical power required-power available curve for an average personal airplane. The power available and the surplus horsepower for climb are shown for the same three propellers of Fig. 4. The increase in the surplus power due to the controllable pitch propeller is self evident and this results in a material increase in the rate of climb. The controllable pitch propeller shown on the chart is the two-position type.

For the average propeller blade characteristics the rate of climb can be expressed by a relatively simple formula as follows: (Ref. 3)

$$C_o = K_1 \frac{P}{W} - K_2 \left(\frac{W}{b^2 e} \right)^{\frac{1}{2}}$$

C_o = Initial rate of climb (ft./min.)

P = Rated power (hp).

W = Gross weight (lb).

b = Wing span (ft).

e = Airplane efficiency factor.

K_1 = 20,500 for fixed pitch and 24,500 for controllable pitch propellers.

K_2 = 470

The right hand side of the equation is constant for a given airplane. Therefore, any increase in the value of the left hand side such as produced by a controllable pitch propeller results in an increase in the rate of climb.

Ceiling

The service and absolute ceilings can be increased by the use of a controllable pitch propeller. The degree of improvement depends upon the allowable operating conditions of the engine at altitude. The increase in the ceiling, if full rated altitude power can be obtained, is shown in Fig. 4, in which the absolute ceiling is increased 12 per cent and the service ceiling is increased 17 per cent.

Level Flight Performance

Replacing the fixed pitch propeller with a controllable pitch propeller on a given airplane results in only a minor improvement in the maximum speed and in the cruising speed. The

improvement is due to the ability to select a better propeller blade and pitch diameter ratio for the controllable propeller with the resulting improvement in propeller efficiency, because with the controllable feature the pitch of the propeller can be adjusted in the air by the pilot to give the correct propeller speed for the level flight and climb conditions. In the case of the fixed pitch propeller the designer is limited because he has to select a pitch diameter ratio to give the best compromise between level flight and climb conditions.

However, the increase in the level flight speed for the same power varies as the cube root of the increase in propeller efficiency. For increases in efficiency up to 10 per cent the increase in speed can be obtained by dividing the increase in efficiency by 3. For example, a six per cent increase in propeller efficiency results in a two per cent increase in speed. At 120 mph this would be 2.4 mph.

There have been many erroneous interpretations of the increase in cruising speed which could be obtained by simply replacing the fixed pitch propeller on a given airplane with a controllable propeller. In every case which has been investigated, it has been found that the major portion of the increase in speed, especially with a multiple position or constant speed propeller, has been due to the greater amount of power which is

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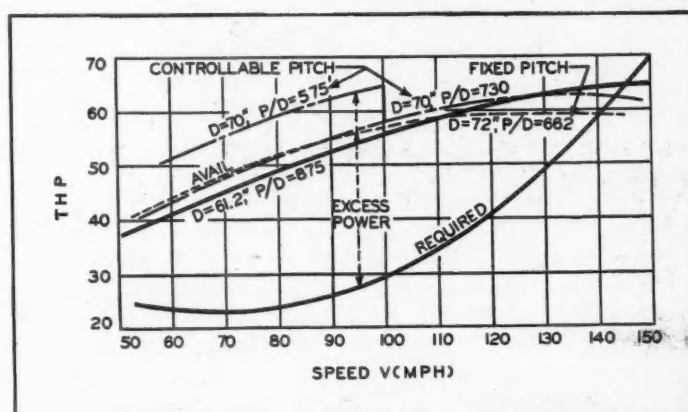
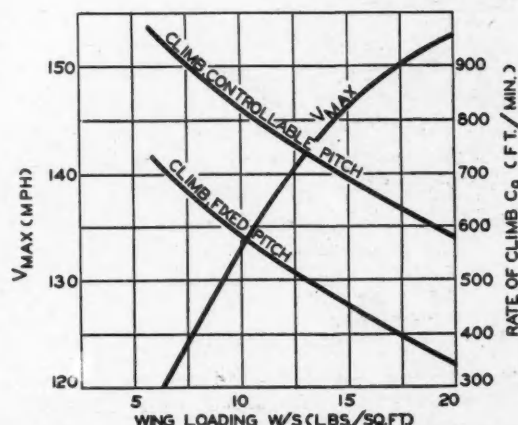


Fig. 5—Typical performance chart—fixed pitch and controllable pitch propellers.

Fig. 6—Variation of V_{max} and rate of climb with wing loading—fixed pitch and controllable pitch propellers.



Parish Again

ALTHOUGH the Parish Pressed Steel Co., Reading, Pa., is recognized as the leading producer of heat-treated frames for heavy duty trucks and buses, only the real old-timers of the industry possibly will recall that back in 1905 when the company was organized, Parish made heat-treated frames for passenger cars. With the advent of better roads and improved engineering, it was found possible to dispense with heat-treated frames for automobiles. But the truck builders who were approaching an era of high-performance

(Left) During the war Parish acquired a great deal of modern equipment for its Arsenal project. Typical of this is the Sellers horizontal boring machine now installed as a part of the new toolroom

(Below) A heavy stamping plant requires extensive facilities for making tools and dies and maintenance of equipment. This shows part of one section of Parish tool room facilities



Producing Passenger Car Frames

By Joseph Geschelin

vehicles capable of carrying greater gross weight created a still greater demand for heat-treated frames made of alloy steels.

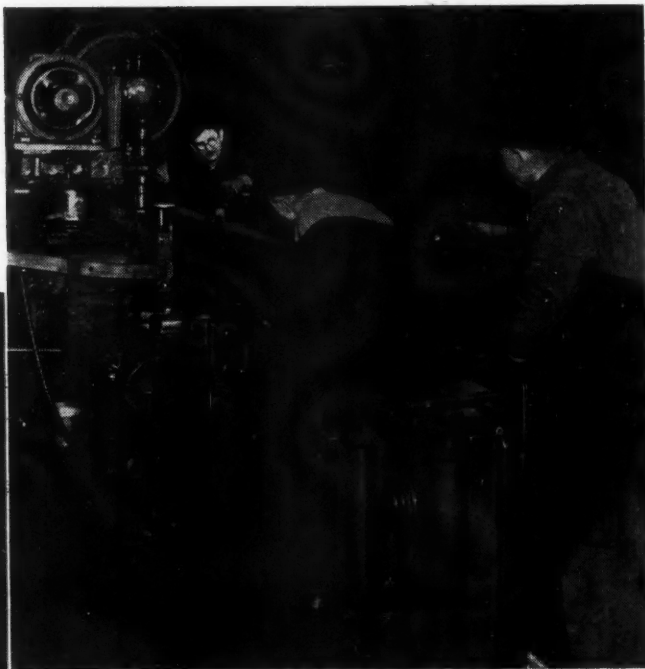
History repeated itself in 1937 and Parish again embarked upon the manufacture of passenger car frames on a mass-production basis. The specialized department for this purpose was dismantled when Parish became engaged in war products, but at the present writing the facilities have been completely restored and the company is now producing frames for two popular makes and has accepted a contract for another make. The company also makes a wide variety of heavy stamped products for other industries. However, the scope of this article has been purposely confined to frame manufacture.

Requirements of modern high-performance, heavy-duty trucks and buses demand great strength and freedom from fatigue in the chassis frame structure. Side rails for such vehicles run upwards of 440 in. in length with depth of channel ranging from $10\frac{1}{2}$ to 12 in. Stock for frame members runs from $\frac{1}{4}$ to $\frac{5}{16}$ in. in thickness and must have excellent drawing properties, particularly the ability to take bends of 90 deg. without

cracking or wrinkling. To give some idea of the fabrication and handling problem encountered here, consider that a typical side rail, alone, running something over 300 in. in length will weigh around 350 lb.

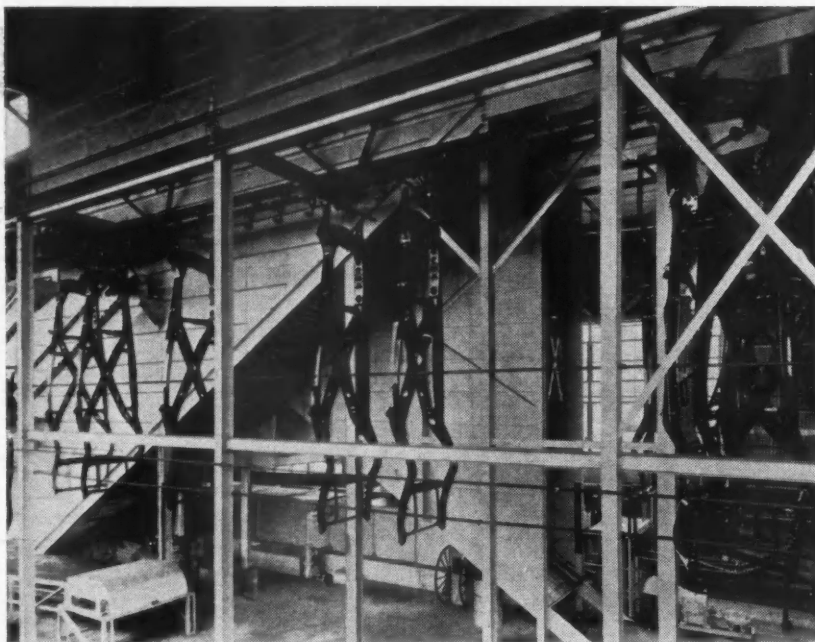
Materials specifications for heavy duty frames depend upon frame size, loading, and range of stress. Some extremely large frames—for trailers as an example—are made of carbon steel without heat treatment. Most truck frames today use 24-34 point carbon steel, or high manganese steel, or one of two types of low-alloy high tensile steel—Great Lakes N-A-X or Alan Wood Dynalloy. While earlier practice was confined almost entirely to chrome-nickel steel, today this material is used in only special instances.

In Parish practice, the carbon steels are rated with an elastic limit about 60,000 psi; chrome-nickel about 90,000 psi; high manganese about 80,000 psi, the prop-



(Above) Following heat treatment side rails are straightened section by section in heavy duty straightening machines such as the one shown above. This is an exacting job, requires skilled workers and a group leader having years of know-how

(Left) Heated treated side rails are subjected to Brinell hardness testing, sampling being made at various points, depending upon size and shape



Perspective view of the Dry-Sys unit for finishing passenger car frames—an integrated combination of washing, spraying, drying stations. Painted frames are shown leaving the drying oven and on the way to the shipping station

erties of alloy steels being taken in the heat-treated condition. Choice of materials, therefore, is based on the physical properties required in each specific case.

Considering the specialization in heavy stampings having high tensile properties, it is only natural to find equipment dwarfing the conventional presses found in an automotive stamping plant. Parish has some 75 presses ranging from small units rated 31 tons to enormous hydraulic presses of 4000 tons capacity. Perhaps the most impressive of these are the new Clearing mechanical presses, massive and of huge proportions, with surprisingly rapid cycles and quiet in operation. Among these are two Clearings used as a team on the formation of heavy-duty side rails. The larger, for forming rails, is rated at 3000 tons and has a 380-in. bed; its companion rated 1500 tons handles the blanking and perforating in preparation for forming.

In the passenger car frame department, a Clearing press of 2700-ton capacity draws the right and left hand side rails in one operation, the blanks being prepared on a 2700-ton Hamilton press. The 4000-ton hydraulic presses, one of them made by Mesta, represent the oldest equipment in use, and are said to be the earliest examples of presses developed for side rail forming. At the present

time these are used exclusively for short run jobs.

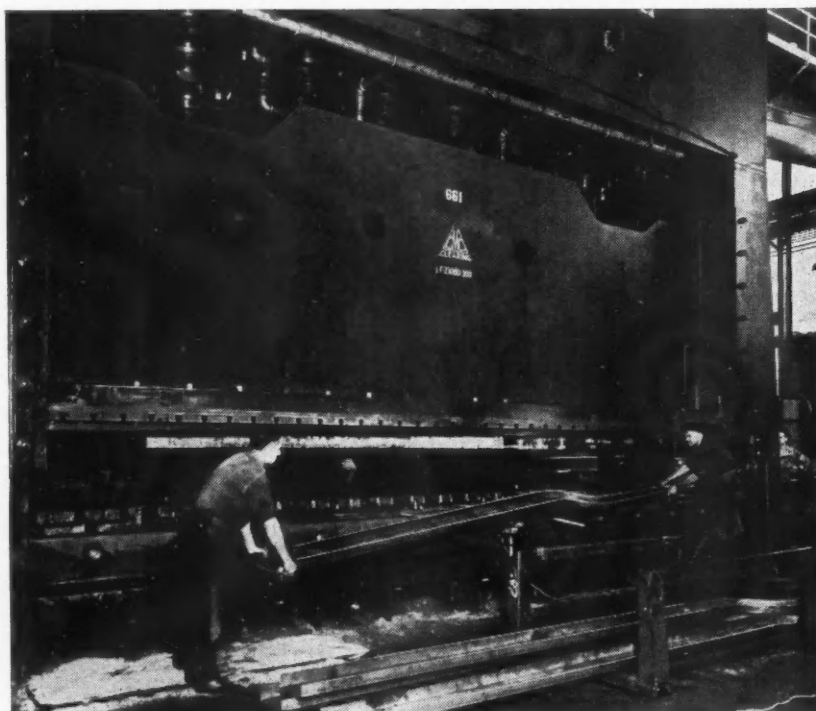
Ignoring the multiplicity of individual frame designs, perhaps the best way to visualize the process is to take a typical case and trace the major steps in the production of a heat treated side rail. Raw material is received in plate form in widths and lengths suitable for economical blanking in the 1500-ton Clearing press. Alloy steel blanks are annealed in the long heat treating furnaces prior to blanking and perforating so as to relieve initial strains and develop the proper

ductility for the severe forming operations. The annealed blanks then go to the 3000-ton Clearing press for forming. Despite the unusual length of bed of this press, some of the side rails are so long as to make it necessary to form in two successive operations.

Following this, the side rails are ready for heat treatment. The work is first heated, then oil quenched in the adjacent tank, then routed to the furnace for tempering. It is not feasible to give the temperature and time involved in each of these cycles since the heat treatment depends entirely upon the type of material used and the size and mass of the work.

Surface finishing operations depend upon the nature
(Turn to page 80, please)

Dominating the scene in the heavy frame department is this enormous 3000-ton Clearing press used for the forming of side rails. The large side rail with severe kick-up shown here is intended for trailers and is typical of the type of work produced here



Airbriefs

By Robert McLaren

Forming Dies

The fabrication of forming dies for a limited quantity of experimental parts at an absolute minimum cost has presented a perplexing problem to the aircraft industry. During the war it was dismissed temporarily but has become of critical importance following reconversion and the necessity for drastic economies. Following extensive tests of numerous alloys, Kirksite has been found ideal for the purpose and at least one propeller manufacturer is now using this well-known material for experimental die fabrication.

Jet Thrust Indicator

One of the major problems of jet engine aircraft design is an accurate measurement of static thrust. This problem is rendered more complex in the resonant jet engine (as used in the Nazi V-1 Flying Bomb) due to the intense vibration of the 50 cycle per second operation. A new device, the Hagan Thrustorg, has been used successfully by the Air Materiel Command at Wright Field for tests on the JB-2, an American version of the bomb. The device utilizes an air chamber with a compressed air line, a manometer tube containing tetrabromide-ether and a diaphragm actuated by the engine being tested. Through the pressure-balance principle, static thrust of the engine is read directly from the calibrated manometer tube.

Future Prop

A prediction of propeller usefulness at speeds as high as twice that of sound (1520 mph) has been made by Dr. R. H. Mills, Propeller Laboratory, Air Materiel Command, Wright Field. Dr. Mills states that such a propeller would be about six feet in diameter, three feet of which would be covered by a huge spinner, contains six or eight blades and have a rotational speed of 7000 to 8000 rpm, nearly three times that now in use. Blade tips would have heavy sweepback. He states that propellers up to 30 ft in diameter are now under development for large military

aircraft (as compared to the monster 19 ft. propellers used on the giant Consolidated Vultee XB-36 bomber).

Turbine Transport

The switch to gas turbine power plants on the huge Lockheed Constitution airliner has been announced. Although the prototype, now nearing completion as a Navy project designated XR60-1, is powered by four Pratt & Whitney R-4360 Wasp Major 3500 hp reciprocating engines, commercial versions scheduled for 1947 will be powered by 5000 hp gas turbines driving propellers. This version is expected to cruise at better than 350 mph. The gas turbines are being developed by Menasco Manufacturing Co.

1000 Mph

Engineers of the Air Materiel Command, Army Air Forces are confident that the Bell XS-1, new secret supersonic aircraft now being fitted with rocket propulsion at Wright Field, will be able to attain a speed of more than 1000 mph. Flight tests of the strange craft will take place at Muroc Army Air Base, Calif., early this Fall. Secret of the plane is provisions for an enormous burst of power as the speed of sound (760 mph) is reached. It is at this speed that shock waves form and produce a tremendous drag on the wings of the plane. After passing through this sonic region the power requirement drops back sharply to its subsonic figure. Although many questions remain to be solved before supersonic flight becomes a practicality, most informed sources firmly believe that man will travel faster than the speed of sound before this year is out!

Whittle Tour

Air Commodore Frank F. Whittle, RAF, inventor of the jet propelled airplane, is now in this country on a two-month lecture tour arranged by the British Information Services. Interviewed in Washington, D. C., he stated that the Allies had learned little from captured German turbo-jet engines and aircraft and that they were far behind

the British and Americans in gas turbine metallurgy at the end of the war. He expressed the opinion that the original Whittle W-1 engine, first flown on May 15, 1941, was superior to the types in use by the Germans when defeat came. The latter used 40 per cent more fuel and lasted 1/5th as long, he said. He is confident that airline transports will be flying at 500-600 mph within five years using turbo-jet engines.

The Skimmer

The Navy has released photos and data on the Vought XF5U-1 Skimmer, following exclusive revelation of the design in this column May 15. It consists simply of a circular wing with large counter-revolving propellers at the tips. Although an aspect ratio of unity violates good aerodynamic practice, secret of the design is the fact that the propellers turn against the wingtip vortices, thereby preventing occurrence of this largest single threat to aerodynamic efficiency. Although the plane has made numerous successful flights in earlier wooden-fabric versions, first flight of the all-metal XF5U-1 Navy combat version is not scheduled until early in September.

Aircraft Instruments

The introduction of the helicopter and jet-propelled aircraft have posed new problems in instrumentation. Engineers of the General Electric Co., Rockefeller Institute and the Bureau of Aeronautics, Navy Department, have collaborated in the design of new instruments capable of measuring airspeeds as low as 2 1/4 mph and as high as 1000 mph. When present airspeed indicators failed to measure speeds of less than about 45 mph, the Navy developed a variation of the anemometer type used on lighter-than-air craft. The Bureau of Aeronautics has produced a set of light-weight anemometer cups mounted on practically frictionless bearings which will rotate at speeds of less than 2 1/4 mph. The problem of high speed indicators was entirely different and the solution was provided by Dr. Theodore Shedlovsky of the Rockefeller Institute. The new indicator is an outgrowth of his research on hot-wire anemometers designed to indicate temperature. Shedlovsky discovered that the difference in rise of two anemometers was proportional to the square of the airspeed.

R. G. Jewell, C. F. Savage and C. A. Edman, all of the General Electric Co., pointed out the peculiar problems associated with turbo-jet engines and helicopters in papers delivered before the ASME Aviation Meeting in Los Angeles. Edman stated that there is an immediate need for accurate measuring devices for turbo-jet tailpipe temperature.
(Turn to page 82, please)

Bond Testing of Silver-

FOR heavy duty applications where high loads, high temperatures, and high surface speeds are encountered, the silver plated steel bearing has established an excellent service record in aircraft engines. Plated with a thin layer of lead and indium to improve its performance, it is used as a bearing for crankshafts, master rods, and other highly stressed parts. Because of its excellent anti-galling properties, a thin silver plate is used on articulated rod pins, tappet roller pins, and other closely fitted parts. The critical nature of all these parts makes it extremely important that the silver adhere strongly to the steel back. Failure to do so can result in complete breakdown of an engine.

Even with the most carefully controlled production electroplating processes, poorly bonded silver occasionally occurs. The defective area may be small or it may extend over the entire plated surface. Such a condition can be caused by improper cleaning or etching prior to plating, failure to connect current to the part before immersion in the plating bath, or any of a number of other reasons. Although the percentage of defective parts is normally low, the high standard of quality regularly maintained in aircraft engines requires that non-destructive inspection for bond be performed on every silver plated part. The methods used must test the entire plated surface, experience having shown that small areas with poor adhesion may occur at random on a part most of which has good silver adhesion.

Over a period of four years, a number of inspection methods which vary in effectiveness and adaptability have been developed for testing silver bond. These can be divided into two classes: methods which can be used on a finished part and methods which can be used only on semi-finished parts. In the first group are the Supersonic Pulse Method, Fluorescent Penetrant Oil Method, and the Whirl Test. The second group in-

cludes the Shear Test, the Roll-Peen Test, and the Shot-Peen Test.

The first device used by Pratt & Whitney Aircraft for silver bond inspection was the Supersonic Reflectoscope (Fig. 1) (see page 32, Nov. 15, 1945 issue, *AUTOMOTIVE AND AVIATION INDUSTRIES*), invented by Dr. F. A. Firestone of the University of Michigan. This complex electronic unit produces pulses of high frequency current which are applied to the faces of an X-cut quartz crystal. The crystal, ground to fit the curvature of the bearings and separated from the parts by a thin film of oil, radiates corresponding pulses of supersonic vibrations into the plate. If the plate is

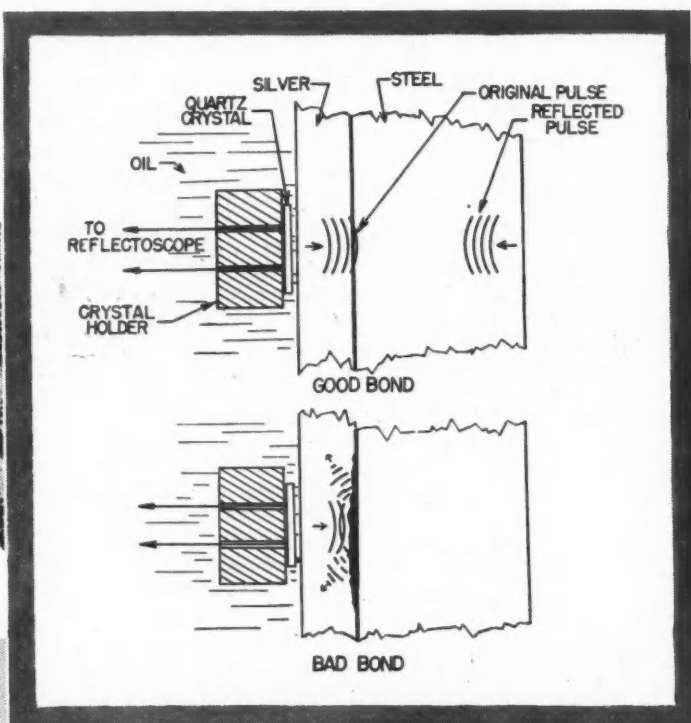


Fig. 1. (Left) While rotating bearing mounted in oil-submerged scanning jig, operator observes patterns on Supersonic Reflectoscope Oscilloscope.

Fig. 2. (Above) Supersonic pulses are dispersed by bad bond but pass readily through good bond.

Plated Engine Bearings

in contact with the steel back, the pulse passes from the silver into the steel, thence to the opposite surface, where it is reflected back over the same path to the crystal. If the silver is slightly separated from the steel back, the pulse is either reflected or dispersed at the gap (Fig. 2). By observing the amplitude and shape of the pattern on the cathode ray tube screen as the crystal is passed over the plated surface, the operator differentiates between areas of good and bad bond.

During the two years that this method was used for routine inspection by Pratt & Whitney Aircraft, certain limiting features of the Reflectoscope became apparent. The device is sensitive to slight depressions and roughness in the plated surface, to microporosity in the silver, and to

By Frank D. Hallworth

Engineer, Materials Development Laboratory,
Pratt & Whitney Aircraft Div.,
United Aircraft Corp.

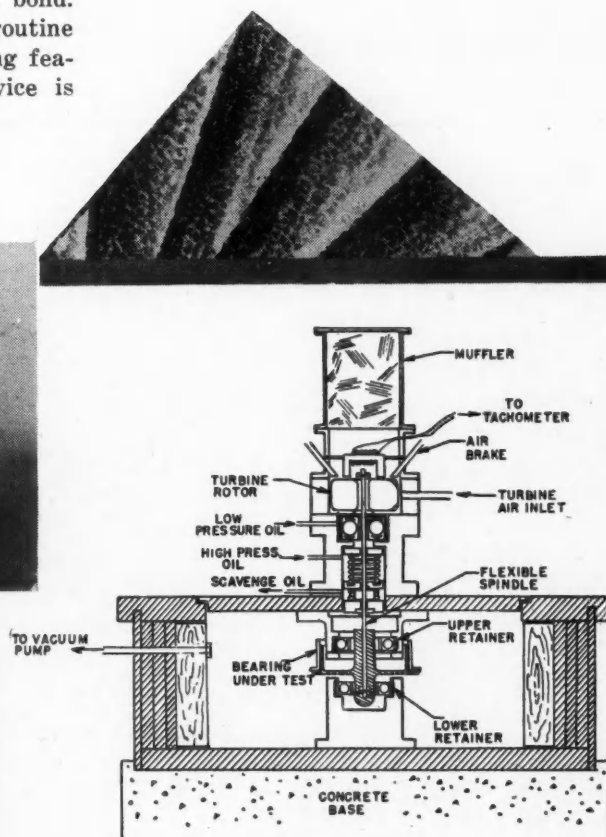
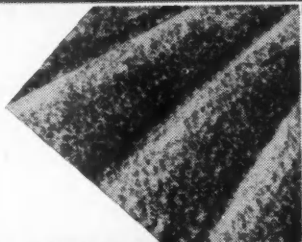
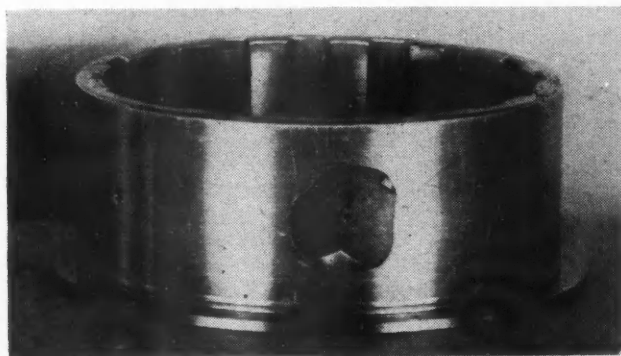
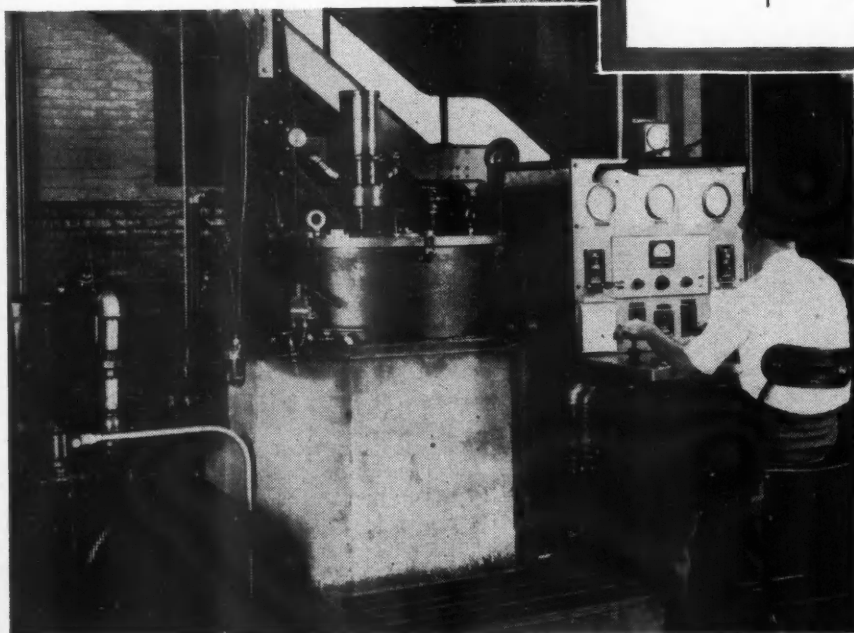


Fig. 3. (Upper Left) Defective double wasp front counterbalance bearings after whirl testing at 40,000 rpm.

(Left) Whirl test apparatus. Parts are centrifugally tested for silver adhesion in the armored chamber (center) by whirling at speeds up to 40,000 rpm.

(Above) Cross section of whirl rig turbine and test chamber. Retainers limit the eccentric rotation during the period of instability accompanying a bond failure.



inclusions in the steel back, all of which give screen patterns similar to that produced by bad bond. Most important of all, it detects lack of adhesion only when an actual gap exists between the plate and the steel back, a condition which may not be present even though there is a complete lack of bond. For these reasons, the Supersonic Reflectoscope did not prove a completely adequate inspection device for silver bond and was superseded by later methods.

Fluorescent Penetrant Method

The fluorescent penetrant method is useful for bond inspection only when lack of adhesion exists at the

edges of a plated part. Bearings are immersed in oil at 275 F, washed in kerosene, degreased, and after a draining period, examined under near ultra-violet light. During the draining period, oil which has been trapped between the silver and the steel at an area of bad bond seeps out slowly. Under "black-light," the released oil fluoresces and appears as a sharp, bright line at the edge of the bad bond area. Care must be used when this method is applied to bearings which have been machined, since machining has a tendency to smear over the edges of the plate. The oil is thereby prevented from entering the areas of bad bond.

Whirl Test

The whirl test consists of spinning an externally plated bearing about its axis at extremely high speeds. Bearings having small areas of defective plating will become blistered during whirl-testing while the silver on larger defective areas will become completely detached. The apparatus used comprises an armored chamber, a vacuum pump, and an air turbine having a maximum speed of 60,000 rpm (Fig. 3). The bearing is mounted on an arbor suspended below the turbine on a thin spindle. Because of the spindle's flexibility, rotation takes place about the true

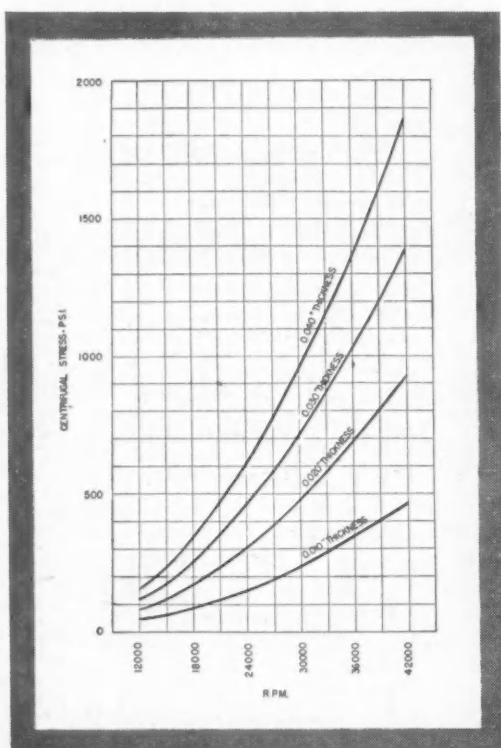


Fig. 4. (Left) Calculated values of centrifugal stress vs. rpm for double wasp front counterbalance bearing. Values are shown for various thicknesses of silver plate.

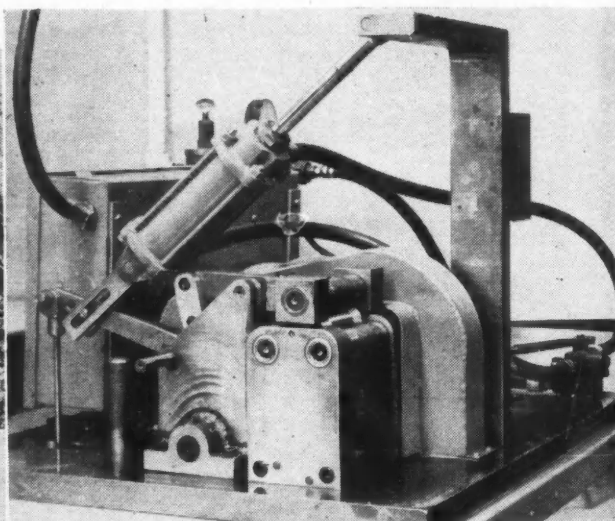
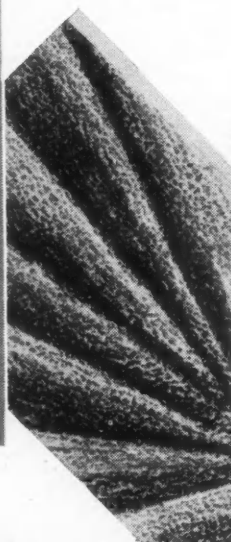


Fig. 5. (Left) Shear testing a front counterbalance bearing. Inset shows appearance of defectively bonded silver.

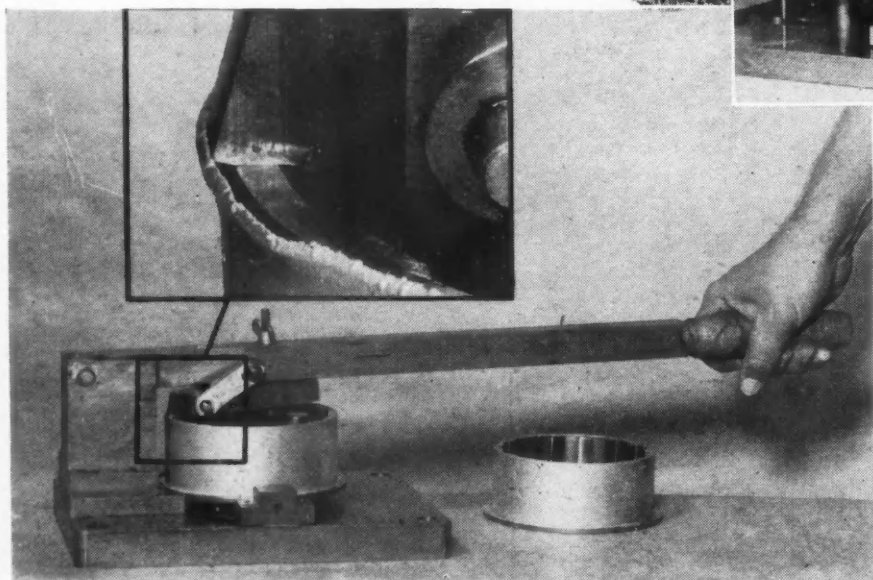


Fig. 6. (Above) Roll rig for roll-peen testing articulated rod pins. Pressure is applied to the pin by the top roll.

center of mass. This enables the rotating system to compensate for any slight unbalance of the part being tested. Since bearings are generally small in size, symmetrical in shape and light in weight and since they are held to very close machining tolerances, it has not been found necessary to dynamically balance each part prior to whirl testing. However, the duraluminum arbor on which the bearings are whirled must be made as light as possible and dynamically balanced to very close tolerances. If large or irregular shaped objects are to be tested, it is necessary to accurately dynamically balance either the part alone or the part and arbor assembly prior to whirling.

In this test, the centrifugal stress developed in the silver causes badly bonded plate to pull away from the steel back. This stress is directly proportional to the thickness of the silver plate, to the diameter of the bearing, and to the square of the angular velocity. Calculated stress values for a Double Wasp front counterbalance bearing, approximately five in. in diameter, are shown in Fig. 4. The minimum stress considered necessary to test the plating of a part is 600 psi, a figure determined by a series of tests on bearings with known areas of bad bond. The highest speed to which a given type of bearing

may be whirled is fixed by the elastic limit of the steel back. To make the test as severe as possible, parts are whirled at a speed slightly below that which permanently distorts the steel back. The Double Wasp front counterbalance bearing is whirl-tested at 40,000 rpm. Since the resulting stress is proportional to the silver thickness, bearings should be whirl-tested following the plating operation before any silver is removed by machining. No evidence has been found that good bond is adversely affected by this test, even at speeds which permanently deform the steel back.

To whirl-test bearings which are plated on the ID, a turbine arbor was made in which several bearings were mounted at a distance from the center of rotation. The centrifugal force tended to detach the silver from the sides of the bearings nearer the center of rotation. At least two whirl-tests were necessary for

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Fig. 9. (Right) Curve represents approximate minimum shot-peening intensity required to cause various thicknesses of badly bonded silver to blister.

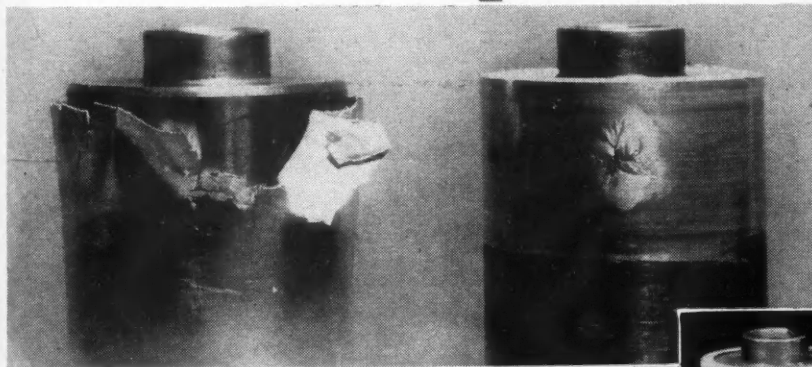
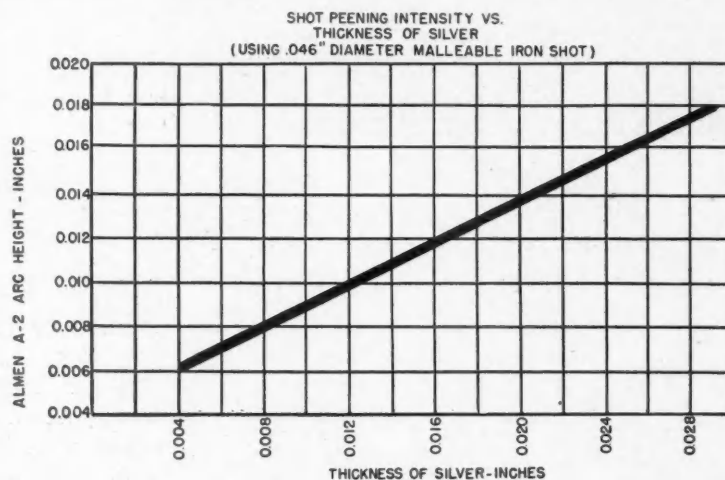
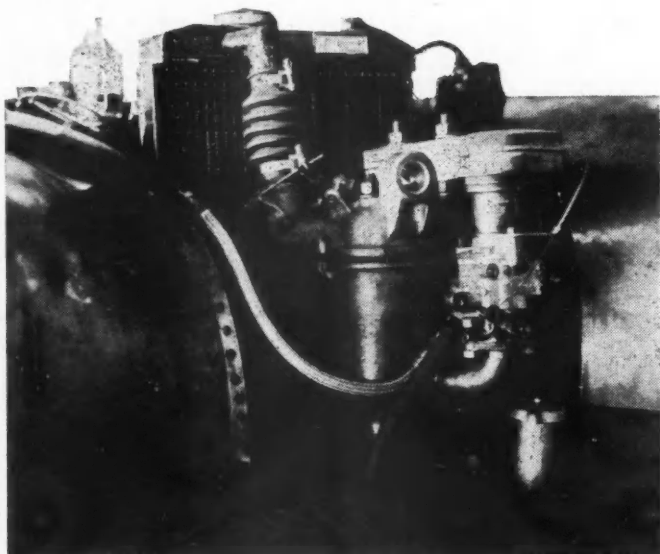


Fig. 7. (Above) Roll tested articulated rod pins having badly bonded silver.

Fig. 8. (Right) Shot-Peen tested articulated rod pins with defectively bonded silver plate. The image shows three cylindrical pins with a rough, textured surface due to shot-peening.

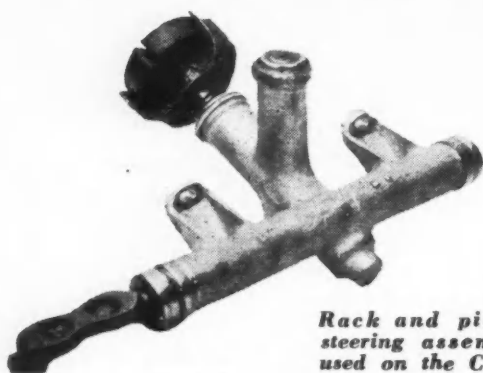


Extreme Economy in Small



(Left) The engine installation in the little Chausson car showing the radiator back of the engine; notice the fuel tank filler pipe at the front.

(Below) Three speed transmission and final drive, the rubber cover at the left houses the universal that drives the right front wheel.



Rack and pinion steering assembly used on the Chausson.

CLAIMED to be the cheapest and most economically operated automobile in the world, the two-passenger car built by the Chausson Company, of Paris, France, has a unit body and chassis of sheet steel, spot welded, with independent suspension all round and front wheel drive by a single cylinder two-stroke engine of 350 cc.

The complete car weighs 617 lb. Body width is 42 in. leg room 39 in., on a wheelbase of 69 in., with an overall length of 118 in. and a wheel track of 36.2 in. The baggage compartment is 31 by 25 in.

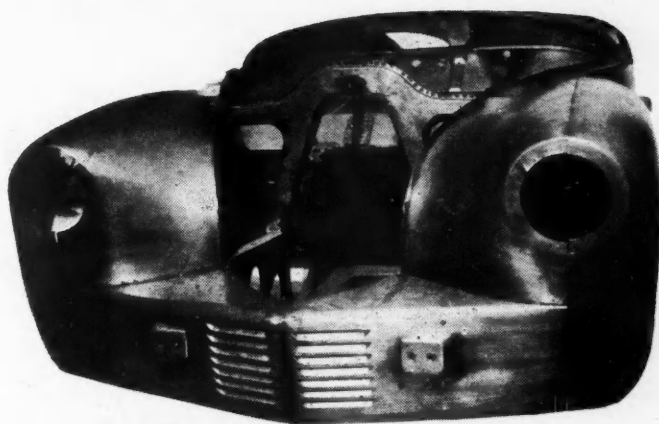
Chausson light car has no doors; the driver and his passenger tilt the top back and step over the side.



French Car

By W. F. Bradley

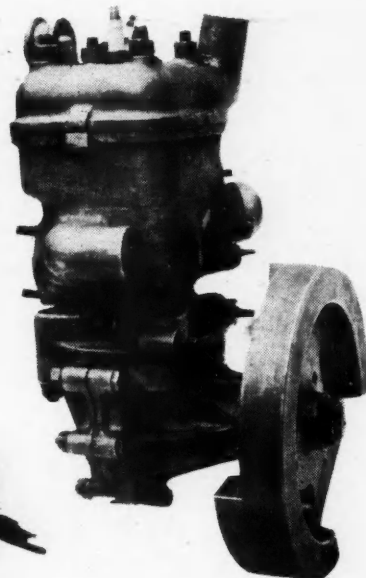
Special Correspondent of AUTOMOTIVE
and AVIATION INDUSTRIES in France



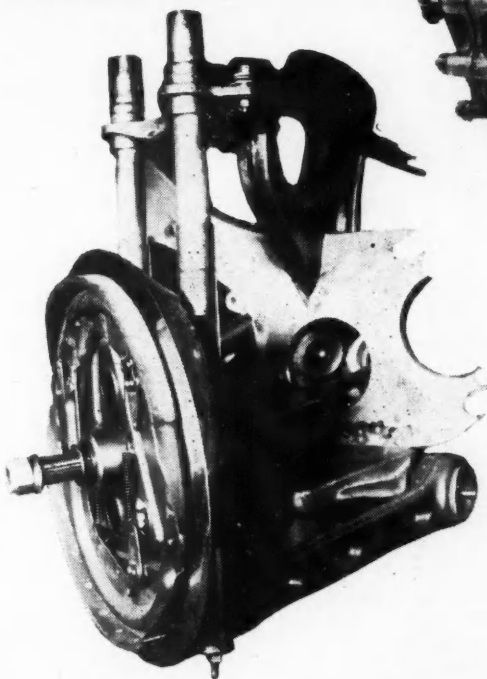
Two views above showing the spot welded, sheet steel, chassis-body of the French designed "most economically operated automobile in the world."

The Chausson Company, who designed this car during the German occupation and have since pushed it forward until they are ready for the production stage, are the biggest sheet metal workers in France, specializing in radiators, buses, and truck bodies. They hold the opinion that for cheap, big quantity production, sheet steel holds the advantage over light alloys. This car has no chassis, and the complete body; forming box sections, is spot welded without the use of a single bolt or rivet, and weighs only 176 lb. The biggest of the steel pressings are the side members, the full length of the car, with the two wheel housings, one half of the fender and one half of the headlight well. With a view to rigidity, there are no doors the height of the side member, where access is attained to the car, being 15 in.

Apart from the chassis-body, steel stampings have been used for the brake shoes and the backing plates, while the pressed steel wheels have integral drums of



(Above) Two-stroke single-cylinder 350 cc engine that powers the Chausson midget.



(Left) front wheel suspension and brake of the 617 lb two-seater; rear suspension is very similar.

12 in. diameter. The independent suspension is almost entirely built up of steel pressings. Each wheel hub has a vertical movement on two parallel steel tubes, the load being carried on two coil springs having a high degree of flexibility mounted in these tubes. Two other springs are mounted perpendicularly to the tubes, but only come into action progressively as the

(Turn to page 68, please)

Salt Bath for

By Keith Whitcomb

Electro-Chemical Laboratory,
Ryan Aeronautical Co.

EXHAUST manifold parts are made at Ryan from sheets of columbium or titanium stabilized stainless steel of the basic 18-8 type with modifications of finish and composition specified by the laboratory. These sheets are cut, stamped into half sections and tack-welded. Then they are trimmed and seam-welded by either atomic hydrogen or oxy-acetylene methods. After this welding operation, the parts must be annealed to remove the strains set up in the metal by the welding. This eliminates the possibility of failure in the critical area adjacent to the weld and also modifies the grain structure in the weld melt itself. The weld flux must be loosened by a defluxing process in an acid bath, and then removed by sandblasting. The schedule for these operations is:

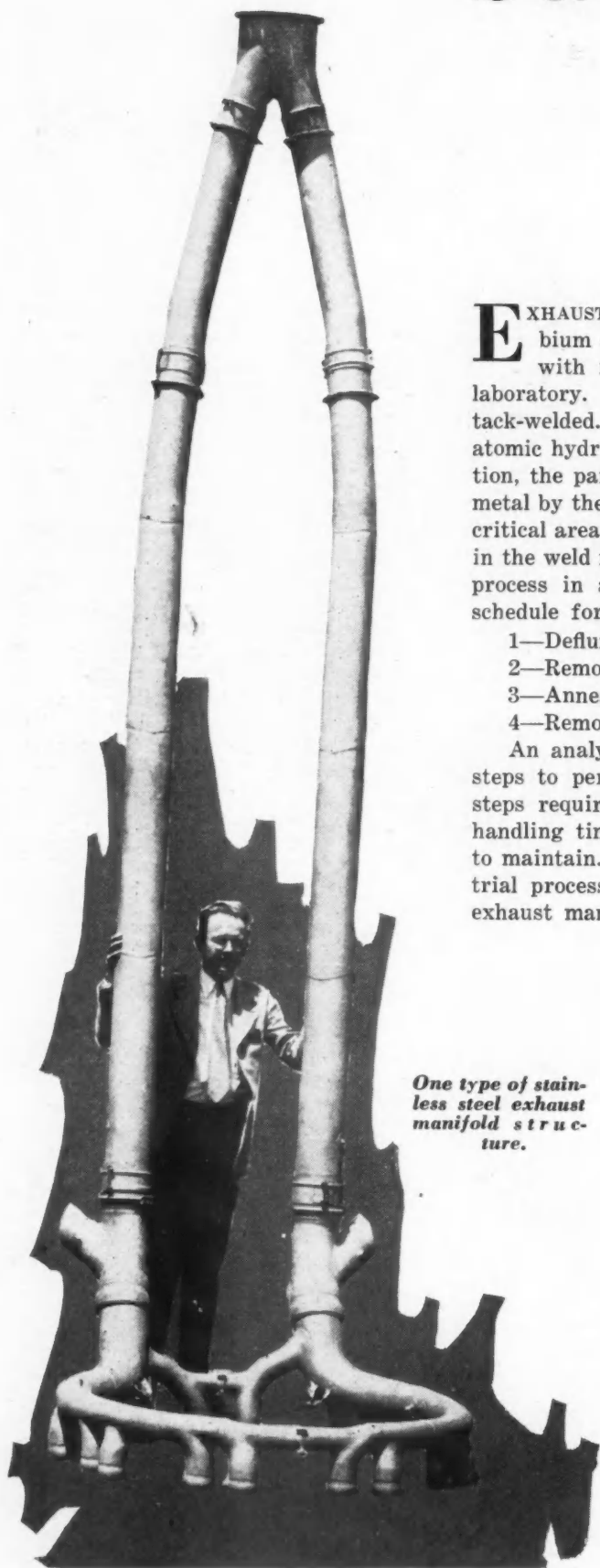
- 1—Defluxing in an acid tank—15 min.
- 2—Removal of flux by sandblasting—2 min. per part
- 3—Annealing heat treatment by air furnace—12 min.
- 4—Removal of scale by pickling in hot acid bath—30 min.

An analysis of the procedure indicates that there are four basic steps to perform the necessary annealing and flux removal. These steps require 59 min. time for the process alone without including handling time. Also, several of these steps are relatively expensive to maintain. Sandblasting, for example, is a rather expensive industrial process. In the search for better methods of mass-producing exhaust manifold equipment at reduced costs, the Research Department began a series of experiments. The result of these experiments has been to produce a new and successful method for the annealing of 18-8 stainless steel and the removal of welding flux. This process is faster and more economical than the former method. Patent applications on this innovation have been made by the Ryan Aeronautical Co.

Early in the course of our investigations we decided that the simplest and most economical method for meeting the requirements would be by the use of molten salt bath, for annealing, followed by a cold pickle acid bath. Such a salt must have several important characteristics:

1. It must have a viscosity at operating temperatures which is low enough to permit low drag out to save time and cost.
2. It must react with the flux, to dissolve it.
3. It must provide a uniform oxide scale of a type easily removed by pickling.
4. It must have a low enough melting point and a degree of stability which will permit it to be safe for employees and the parts to be processed.

One type of stainless steel exhaust manifold structure.



Heat Treating

Stabilized Stainless Steel

Several salt solutions have been on the market for heat treatment of ferrous steels. One of these salts, pure barium chloride, was recommended as being capable of operating at the temperatures which we required without appreciable decomposition. Since the parts are of stainless steel, with high corrosion resistance, the process of rectification was deemed unnecessary.

We installed an electrically heated salt bath in our plant, the furnace itself being a well insulated tank lined with tile. The salt is heated by passing a low voltage alternating current through it by means of metal electrodes which are immersed in the molten salt. The furnace was designed to operate at temperatures ranging from 1950 to 1980 F. When the furnace was first operated it immediately became apparent that pure barium chloride has many disadvantages for use with stainless steel. It decomposes quite appreciably at 1950 F. As a matter of fact, damaging quantities of chlorine gas were liberated by the bath for the first three or four weeks it was in operation. After this length of time the unrectified bath proceeded to dissolve material at the grain boundaries of the cast electrodes which were originally provided with the installation. At the end of 26 days, the first set of them failed completely. Another set was installed and it too succumbed to the corrosive action of the unrectified salt within a few days. At this time the furnace was shut down and a series of experiments were conducted with various metals to get a suitable electrode material. Finally, a set of three in. round forged bars of Inconel were welded on to the arms of the electrodes in place of the cast stubs. These wrought bars have been in use for a good many months and show no signs of wear. A metallographic examination of the material after 90 days indicated that penetration along the grain boundaries had pro-



A quantity of Ryan exhaust manifold parts which have been seam-welded, successfully heat treated with the sodium carbonate salt bath and stored until used by the next assembly department.

gressed only to a depth of approximately 0.125 in.

After overcoming the bothersome problem of finding the proper electrode material, there still remained a major difficulty. Parts treated by the bath eventually became scrap material. The day after the heat treating and pickling processes, the parts exhibited a rusty and pitted surface. In an effort to save them, they were sandblasted to remove the rust and remaining salt, but after a few days of standing, they rusted again. A metallographic examination showed that the salt had penetrated the surface for about 0.003 in. It was felt that if this metal could be removed the parts would be suitable for use. In order to effect this removal the parts were scaled at 1980 F and pickled, but the problem was not solved. After a few weeks every tiny pore, crack and scratch oozed a tiny spot which rusted. We then set out to learn whether or not any salt was suitable for use as a heat treating medium for 18-8 stainless steel.

Several commercial producers of heat treating salts

were consulted and samples of their salts operating between 1650 F and 2000 F were obtained. Each was heated to a temperature of 1750 F in either an Inconel or stainless steel pot by means of a circular gas fired furnace. Samples of stainless steel were then immersed in the salts for varying lengths of time and either quenched in water or allowed to cool in air. In order to determine whether or not pickling was absolutely necessary some samples were pickled and others were not.

The general properties of each salt such as fuming tendencies, mobility, sludge formation and so on were observed. Stainless steel samples were sectioned and examined metallographically to determine the extent of attack if any.

The salts which were tested were all either pure barium chloride or barium chloride with other compounds added. Our determinations from these tests were as follows:

Pure barium chloride: When first heated, it liberates chlorine gas as mentioned before. It makes no difference whether it is heated electrically or by gas. No considerable amount of sludge is formed if the salt is not rectified. During the first few hours of operation, the salt comes off quite easily on quenching in water, but by the second day it becomes very tenacious and extremely difficult to remove. Parts treated in this medium will rust badly if every trace of salt is not removed within a very short time after treatment. At first intergranular attack on the steel is relatively small, but as the bath becomes contaminated with the oxide of barium, the intergranular attack increases markedly.

After the bath had run for 24 hr without rectification, sodium chloride was added in rather large amounts. A great amount of white, acrid smoke, apparently sodium

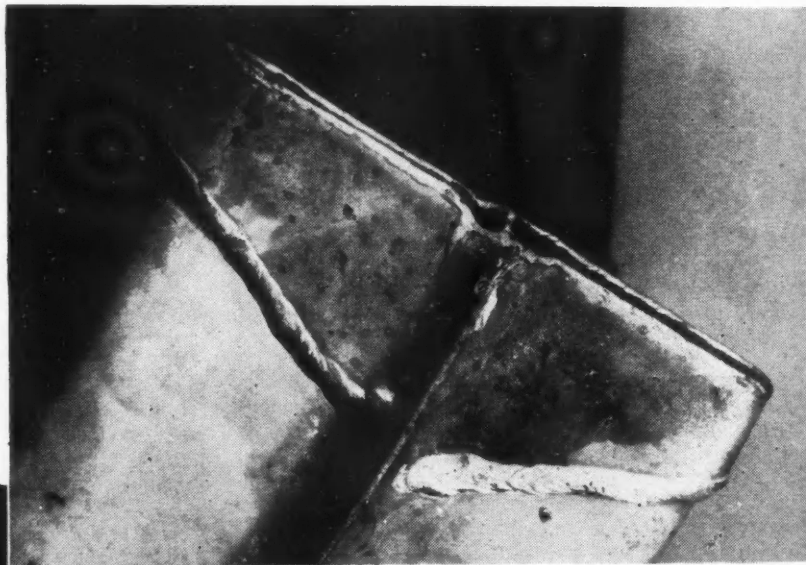
oxide was evolved. After this treatment an attempt was made to maintain a rectified condition with a commercial rectifier. A large amount of hard sludge was formed, and from all indications the bath was finally rectified.

Salts A and B: These salts may be considered simultaneously because they are so similar. They appeared to be composed of barium chloride to which had been added sodium and potassium chlorides. They both fumed rather badly, but presented a clear surface and produced little sludge. Neither salt was rectified during the tests. The same effect was shown here that appeared with pure barium chloride—after operating for a while the salt becomes hard to remove. This stage took longer to reach in the cases of these salts than with pure barium chloride.

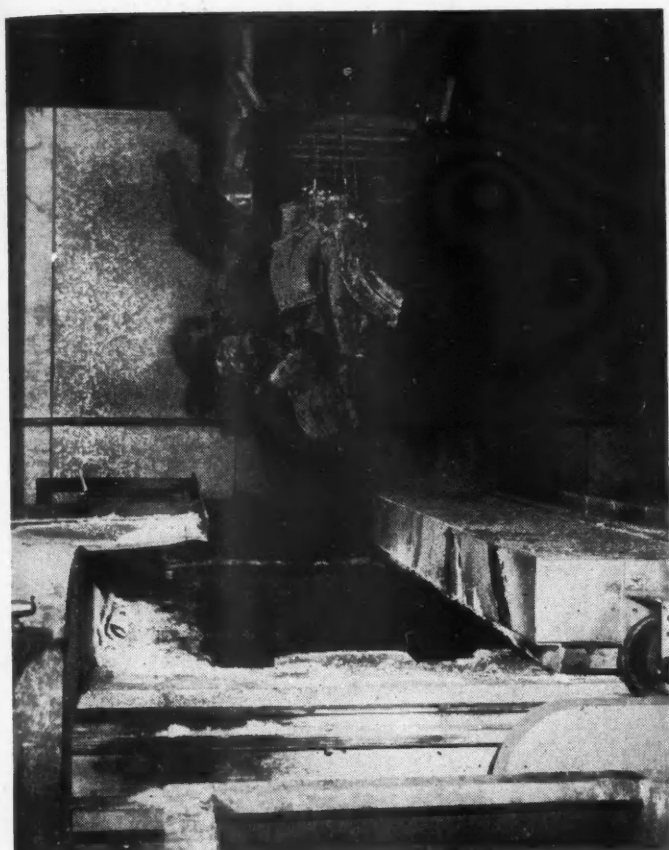
Each of them quenched rather quietly and gave a dull brown to black surface on the metal which was easily removed by pickling. Again, pickling was shown to be insufficient for complete salt removal. Parts rusted over night in areas contaminated by the salt. The flux removing properties of the salts were rather poor. Intergranular corrosion was not excessive until after the bath had been operated for a relatively long time without rectification.

Salts C and D: These two salts may be considered together, also, because of their similarity. They both have the property of being constantly rectified by a blanket of powdered carbon and silicon carbide over the entire surface of the bath. The carbon serves as a neutral insulator between the barium chloride and air

(Below) An exhaust manifold section which was heat treated in the barium chloride type salt bath, pickled and allowed to stand in air for a few days. The bath was rectified with sodium chloride. (15 minutes at 1800 deg. F. 10 per cent NaCl — Air quenched — dropped and pickled.)



(Above) This exhaust manifold part was badly corroded after a heat treatment by barium chloride type salt bath. It was sandblasted to remove the corrosion and allowed to stand with the visible result, each tiny pore rusted.



Molten Salt Bath furnace at the Ryan plant. Furnace is covered by a rolling lid and the quench tank is located in the foreground. Loading device is about to immerse a group of exhaust manifold parts in bath.

while the silicon chloride reacts with any barium oxide that is formed. The rectifier is added to the bath as a fine powder which floats on the surface. As the silicon carbide is used up a hard sludge is formed. Some of this sludge goes to the bottom while the remainder of it is supported by the film of floating carbon and unreacted silicon carbide. This sludge and the presence of the film on the surface made the use of this salt undesirable when another was found which would do the same job without these disadvantages.

At operations which take place over 1700 F, or where a neutral salt is required these salts would be highly recommended. These salts were far superior to the other commercial salts tested. One of them is designed for the heat treatment of ordinary alloy steels and the other for the heat treatment of a high chrome alloy. The difference in their behavior toward 18-8 stainless steel is quite noticeable. In five minutes, one of them will produce a layer of heavily corroded material about .003 in. deep. Unlike the similar layer produced by pure barium chloride, this one pickles off almost completely.

These salts reacted violently when quenched in water. They crackled loudly

and spattered hot salt and water over a wide area. This condition may be caused by the blanket material which sticks to the parts as they are pulled through it upon being removed from the pot. Also, unlike the other salts in their quenching action, the surface of the metal was bright and practically free of all salt. If the parts are cooled in air it becomes a simple matter to remove the salt. Both of these salts removed most of the welding flux from the samples, but in no instance was this removal complete.

Pure sodium carbonate: This is the one salt which was tested as a heat treating medium for 18-8 stainless steel by the laboratory which emerged as a completely satisfactory product. It is practically an ideal salt because it needs no rectification. Baths which have been operated continuously for a month show no signs of giving trouble. The salt is easily removed from the parts by acid and the light scale formed by five min. immersion can be removed by a cold pickle. This makes the entire problem of heat treating welded sections very simple. Since all silica base materials are very soluble in sodium carbonate welding fluxes are easily removed in the bath, which makes it possible to complete the heat treating cycle merely by a five min. immersion in the molten sodium carbonate followed by a cold water quench. The parts are then placed in dilute sulfuric acid to remove the salt, rinsed and placed in the cold pickle for five min. After this treatment the parts are free of all salt and flux and possess a very bright finish. Test bars, having been strain hardened by stretching them to 75 per

cent of their total possible elongation, will give an additional 35 per cent elongation by this five min. treatment at 1650 F. Fifteen min. in an air furnace at 1980 F will produce an additional 40 per cent to 45 per cent elongation on similar test bars.

Up to about 1700 F there is no fuming, but at 1725 F it is noticeable and at 1750 F it becomes excessive. Since the bath needs no rectification, it produces little or no sludge other than the contaminants

(Turn to page 98, please)

Comparison of Properties of Various Salts

	Ba Cl ₂	Salt "A"	Salt "B"	Salt "C"	Salt "D"	Na ₂ CO ₃
Fuming	D	D	C	A	A	A
Surface	A	A	A	C	C	A
Sludge	C	C	C	D	D	A
Quench	B	A	A	D	D	A
Color of part after water quench	brown green	black	brown	bright	bright	black
Stand in air	D	D	D	B	B	A
Flux removal	C	D	C	B	B	A
Intergranular attack	D	B	C	D	A	B
Drag out	A	A	A	C	C	A
Removal of salt by pickling	C	B	B	A	A	A
Rectification	required	required	required	required	required	not required
Operating temp. °F	1900	1750	1750	1800	1800	1700

Observations

BY JOSEPH GESCHELIN

Steam Cooling

MANY years ago Rushmore demonstrated the virtues of steam cooling for motor vehicles. But he was ahead of the times. Now that the industry has had some years of production experience with pressure cooling systems, we understand that serious attention is being given to evaporative cooling by one of the important producers. It is the present plan to use an aluminum radiator core and to eliminate the fan. We hope to hear more about this in the not too distant future.

Cylinder Finish

DISCUSSION of cylinder wall finish must not overlook the possibilities of the knurled cylinder wall. This was used, in one form, by the Germans for radial engines and, in a highly developed form in the single-cylinder test engines being built by Lee Oldfield. According to Oldfield these cylinders have given remarkable service. More recently, Oldfield found it possible to knurl the bore only part way without affecting the results. It is claimed that knurling is not expensive, best results being obtained by honing after knurling to remove the fuzz.

Plastics Glazing

GEORGE B. WATKINS of Libbey-Owens-Ford presented at the S.A.E. Summer Meeting a thought-provoking paper on the subject of automotive glazing with plastics. Although he is, naturally, a proponent of glass—which at the moment remains the best glazing medium—his paper was most objective in its treatment. Analysis of standard tests shows that certain types of plastics have outstanding properties from the standpoint of impact strength. However, none of the glazing plastics have the abrasion resistance essential for either side windows or the windshield. Doubtless most of our readers know that a great amount of work is under way to increase abrasion resistance, at least sufficiently to take care of side glass

requirements. Apparently, the plastic glazing of windshields still is a long way off.

Steering Gear

THE steering gear has undergone some extensive development in recent years, particularly with the introduction of hydraulic types for heavy duty vehicles. Added to the known producers, we learn that one of the machine tool builders is experimenting with a system designed for passenger cars. We also know that a prominent parts maker—in another field of activity—is perfecting a mechanical gear for heavy duty trucks, said to compare with the performance of hydraulic systems.

Navy Diesels

DESPITE the promise of fission energy and gas turbines the Navy, according to Commander W. W. Brown, USN, still is going along with the dependable diesel engine which did such a remarkable job during war. However, the Navy wants diesels to advance with the changing times. Among other things the Navy is looking to higher supercharge pressures with turbochargers; increasingly more horsepower with less weight; a major reduction in the weight of accessories; the use of welded construction; better fuels; and an increasing utilization of light weight materials. In short, what the Navy wants is the fullest advantage of developments now under way in the automotive industry.

Electronics For Industry

THE science of electronics has captured the imagination of people in every walk of life. But apart from its glamor, the science holds much of tangible value to industry. On a recent trip we took time out to visit one of the manufacturers of electronic devices—Photoswitch, Inc., of Cambridge, Mass. They are studying applications in automotive plants, including many new wrinkles such as level controls which make possible the automatic filling of radiators and gas

tanks on the assembly lines; and the spotting of bodies onto chasses automatically. Ultra high speed cameras and ultra high speed counting devices also are under development. Easily the major activity in an organization of this kind is the research laboratory and engineering department.

Swinging Axles

IN THE discussion that followed the presentation at French Lick of the B. F. Goodrich paper on cars with four-wheel independent springing, Barney Roos and R. P. Lewis both mentioned the development of swinging axles and their experimental use for some years. It is evident that axles with body-mounted differentials will be available whenever motor car designers are ready to put them to use. It will be a return to the days of side chain drive in that respect.

Air Gages

AS PRODUCTION men know, the field now abounds in numerous makes of equipment for air gaging in production. We were told at the meeting that one of the fine shops specializing in tools and fixtures is presently working on a new type of air gage which is said to be quite different from the others. Instead of being a comparator this one can be used for precision measurement directly.

Process Machines

UP TO the present moment we have talked about "process" machines more or less academically as applied to motor car machine lines. However, in recent weeks we have had the privilege of looking over the details of a high production line which should be in operation before the end of the year. And more recently we found another large producer who will be installing an ultra-modern tunnel type process line for cylinder blocks by the beginning of next year. These examples foreshadow a revolution in mass production methods.

Metallic Coatings

ACCORDING to *Industrial Standardization*, a program for investigating electrode-position of copper-nickel-chromium coatings of high carbon steel is under way. Subcommittee V of the ASA has appointed a subgroup to study supplementary coatings such as chromate and phosphate type on zinc and cadmium surfaces.

Pouring ingot molds
at Inland's Indiana
Harbor Plant.

New Steels

Our modern, changing world is placing new demands on steel—with particular emphasis on the high-strength, low-weight ratio; durability, uniformity and appearance. As a result, better steels, more versatile and adaptable than ever before, are being developed—some far in advance of the newer uses and improvements they eventually bring about.

Typical result of this intensive research program at Inland is "Hi-Steel" ... solution to numerous high-strength, low-weight ratio requirements in steel construction problems. Daily, Inland metallurgists are engaged in solving current and long-range material problems of Industry. From this experience and from the continuing research program, come the greater achievements of tomorrow.

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NEWS *of the* Industry

At the outset of this month, immediately after the death of OPA, things were at sixes and sevens in the automotive industry so far as prices and labor troubles were concerned. Upon the action of Congress in either blowing a breath of life into the corpse of OPA or giving it a decent Christian burial rested the course of the industry for the next few months. In either case, the result boded no good for the automobile makers, since a continuation of price controls would present the same difficulties it had previously, unless greatly modified, and letting OPA remain in a state of suspended animation would undoubtedly touch off a series of wage demands and ultimate strikes.

Labor Productivity is Key To Holding Prices Down

Whether or not present prices will have to be increased or any future increase retained, depends to a large degree on what labor productivity studies show when volume production is attained. An industry spokesman says that it is impossible to tell now how well labor is producing, but that there are signs that productivity is improving. He said that when lines are full and the tempo of production is at high pitch, the company might be agreeably surprised to find that very near pre-war efficiency is back and that prices could be held. In general, however, the outlook is for some further increases in the price of cars before there is a reduction.

Manufacturers Go Slow On Car Price Increases

Manufacturers made no immediate move to raise prices of their vehicles when price restrictions expired. A survey showed that they were following a course of watchful waiting to see what the ultimate fate of OPA would be before raising prices. One spokesman pointed out that it would be bad public policy to raise prices and then later have to lower them if OPA were restored. It also would lead to unbounded confusion, he said, if prices had to be adjusted first upward and then downward in the course of a few days or weeks. Another element of concern is that prices of cars to the consumer are almost certain to rise either with or without restored controls and regardless of whether the manufacturer increases his price. The reason is that dealer margins, which had been cut

Course of Industry During Next Few Months Depends Upon Action of Congress Concerning OPA . . . Labor Productivity Chief Factor in Holding Price Line . . . No Immediate Rise in Car Prices . . . Increased Prices would Cause More Labor Trouble . . . First Demands for Wage Increases may be Made at Chrysler . . . Strike Threats Seen as Pressure on Congress for Price Control Laws . . . Wage Strike would Put Industry on Spot . . . Production Prospects Brighter . . . Output to Date Far Below Estimates.

about 7 or 8 per cent by OPA, are likely to be restored. The vetoed OPA bill contained such a provision and it is thought certain that if new controls are enacted this provision will be included. If no legislation is forthcoming, the margins are likely to snap back to normal or very close to it. Consequently, prices would rise from \$80 to \$100 on the lowest priced cars and any additional increase by the manufacturer might well boost the price, now considered by many as too high, out of reach of millions of potential buyers. The manufacturers generally believe that they should have some kind of price relief, but are confronted by the dilemma of forcing themselves away from their volume market.

More Labor Trouble Ahead If Prices are Increased

The first violent reaction of organized labor to removal of price controls boiled up within two days after OPA expired. In Detroit, where food and rent prices went sky-shooting in the first brief flurry, mass meetings of protest bloomed forth with angry denunciations and threats of a general strike and mass wage increase demands. Walter P. Reuther, president of the UAW-CIO, said that if prices continued to spiral upward, the union would re-open its wage contracts with automobile companies, provisions to

the contrary notwithstanding. He charged that Congress and industry had made a commitment with labor to hold prices down and that the promises had been broken. Observers, however, were at a loss to explain any commitment by industry in this respect, since that particular issue in the General Motors strike was thoroughly beaten, and certainly did not exist in any other contract in either expressed or implied form.

Chrysler Likely to Be First Wage Boost Target

At any rate, if living costs continue to advance, new wage demands are certain to come. From present indications, Chrysler probably will be the first to feel the blow. Labor there has fared better than at either General Motors or Ford and is showing signs of being cheery and restive. Numerous work stoppages by a handful of employees with imagined or minor grievances have shut down different Chrysler plants on several occasions in the past few weeks. The men have not suffered from a prolonged strike or shutdown and have more reserve to withstand the rigors of a strike. On the other hand, the G.M. workers have not recovered from the financial beating they took in their four-months strike, and Ford workers have lost heavily in wages from forced shutdowns of the company owing to strike-bound suppliers. If strike action is taken, the union is certain to repeat its "divide and conquer" technique by concentrating on one company at a time, and this time it looks as though Chrysler would be the victim.

Strike Threat Action Seen As Price Control Club

While the outlook for labor peace is not too encouraging in the event prices remain uncontrolled, there are several mitigating circumstances that may lessen the wage crisis. It should be remembered that the avowed purpose of strike action would be to force the employer to raise wages. However, another aim at this particular time will be to pressure Congress into enacting price control laws for holding down prices. Undoubtedly, the union heads will make this their principal objective, with the prospects good that they will dicker, threaten and negotiate for some time before actually going on strike. They don't want a strike if they can
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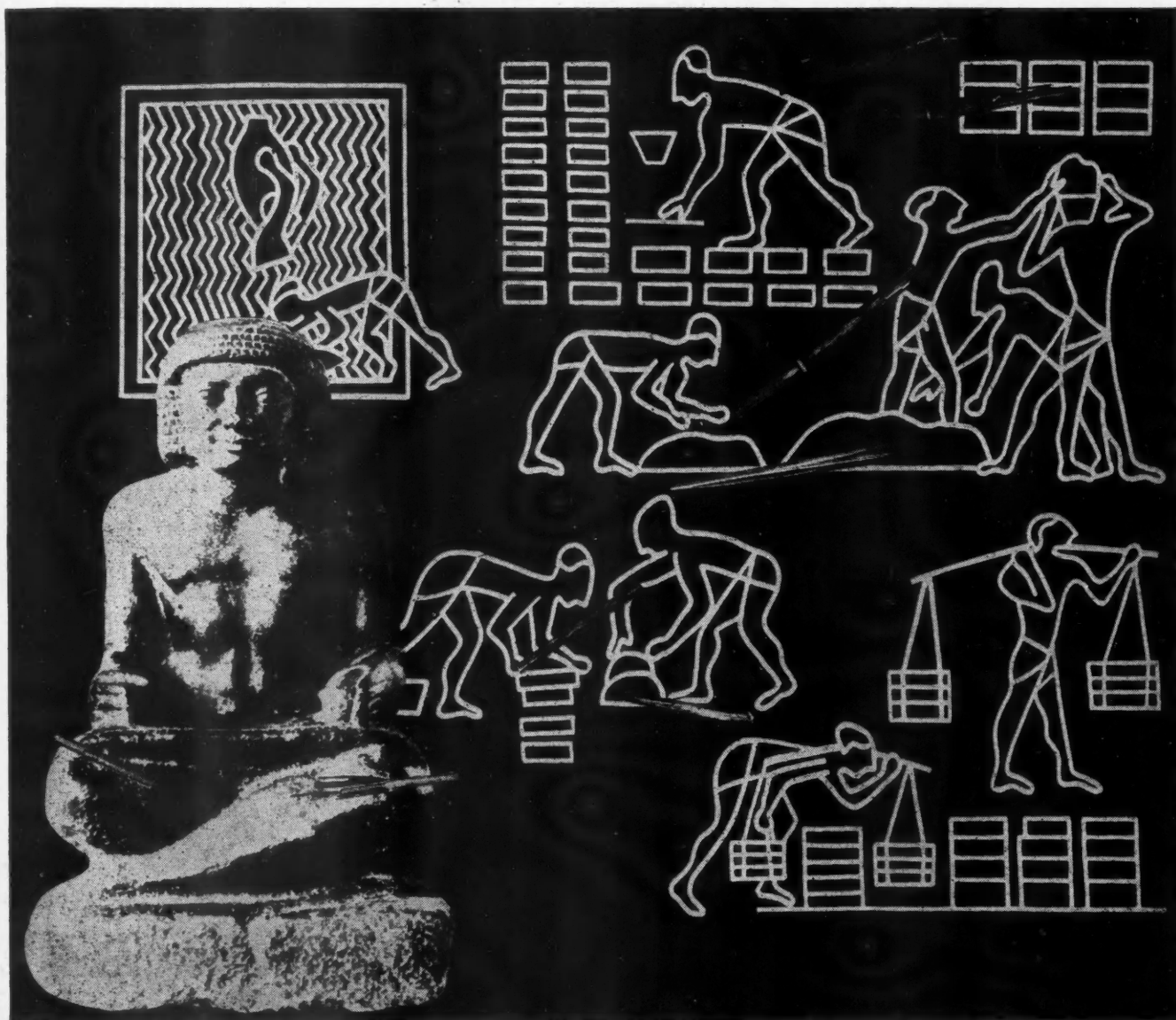
BRICKS WITHOUT STRAW

Long, long ago a penny-conscious Pharaoh tried to cut his cost corners by decreeing that bricks would be made without straw. He found out—the hard way—that scrimping on materials throws product performance and customer good will into full reverse.

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Machining Stainless Steels

The Carpenter Steel Co.—A new notebook of useful information for machining stainless steel, Notebook on Machining Stainless Steels, is designed to simplify stainless machining and provide longer tool life, higher speeds, better finishes. Each chapter in the 116-page book contains a complete check chart that lists possible trouble spots and gives shop tips on how to cure them. Detailed information is given on various operations such as turning, drilling, tapping, threading, milling, broaching, reaming, filing and sawing. A chapter on lubrication discusses proper lubricants and coolants for various types of jobs. The handbook is illustrated with photographs and diagrammatic sketches. Typical stainless parts are shown and blueprints are provided for stainless machining jobs. Special tables indicate recommended speeds and feeds for machining different types of stainless steel. Notebook is available to production and management executives, free, at nearest Carpenter Steel Company representative. Additional copies are fifty cents each.

Electric Tachometer Generator

Square D Co., Kollsman Instrument Div.—A folder on the new Compak Electric Tachometer Generator, a new unit for multi-engine aircraft, includes complete information on weight, space requirements, interchangeability with standard units, operation, types of tachometer outlet connections available and other details required for specifying the units.

Correlation Chart

Arcos Corp.—A large sized data sheet lists every well known stainless steel by trade name with the proper Arcos alloy electrode for welding each. AISI type numbers and analyses of the trade named stainless steels are given as well as the weld metal chemical analysis of the corresponding Arcos electrodes.

Precision Ball Bearings

Jack & Heintz Precision Industries, Inc.—A new catalog on precision ball bearings, together with an interchangeability table.

Electronic Equipment Maintenance

Westinghouse Electric Corp.—Booklet B-3658, Maintenance of Industrial Electronic Equipment, outlines preventive maintenance techniques. Six basic maintenance operations, cleaning, inspecting, feeling, tightening, adjusting and lubricating, are discussed and ap-

plied to vacuum and ignitron tubes, capacitors, resistors, fuses, bushings and insulators, relays, switches, etc. Safety precautions to be observed during preventive maintenance operations are also included.

Organic Coatings

United Chromium, Inc.—An informative 16-page booklet covers the sources, properties and applications of the many resins used in synthetic lacquers and protective coatings. The booklet is attractively illustrated and includes a Unicrome Lacquers check chart of properties.

duPont Fairprene

E. I. duPont deNemours & Co., Inc.—A new booklet describing and illustrating applications of Fairprene, the trade name of its line of sheet stocks (without fabric insert), coated fabrics and cements made with synthetic elastomers.

Thermol-Grandodine

American Chemical Paint Co. — A new folder describing Thermol-Grandodine, a phosphate coating, for promoting resistance to corrosion and wear.

Junior Rotameters

Fischer & Porter Co.—Catalog section 31-E on Junior Rotameters, describes and illustrates this equipment, includes a capacity chart, diagrammatic drawings, etc.

R-B Punches and Dies

Allied Products Corp., Richard Brothers Div.—New 48-page catalog of complete R-B products. Standardized R-B Interchangeable Punches and Dies together with all the parts and accessories which make up the full R-B punch and die sets are features in illustration and fully described with specifications and prices of each. Several

pages are devoted to composite die sections, guide pins, bushings, dowel pins, socket head set screws, cap screws, etc. Many special punch retaining plates and special punches and dies are illustrated. Hardness conversion tables, stamping pressure chart and other technical data, handy index and ordering instructions are included.

Kaiser Licensed to Build Gregoire Type Light Car

Kaiser-Frazer Corp. has completed a licensing arrangement for American rights to use the Gregoire type of light car design (see description of the Gregoire car in AUTOMOTIVE AND AVIATION INDUSTRIES of Jan. 15, 1946, page 26), if and when time appears propitious. This is purely an exploratory arrangement since the Kaiser-Frazer Corp. has no immediate plans for the production of a light car of this type. It may be used or it may be dropped depending upon future developments.

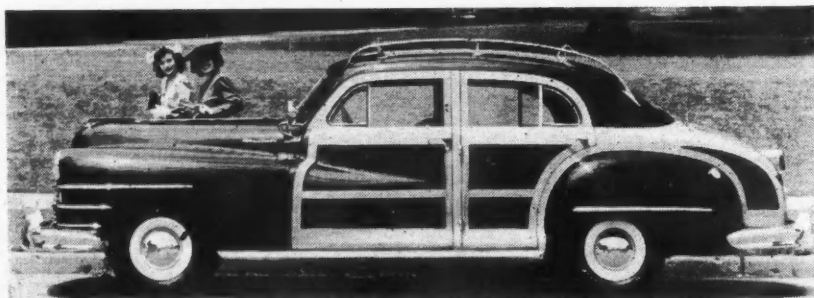
This agreement is said not to have any bearing upon plans for building the Kaiser Front-Drive car. Plans for immediate production of the Kaiser had been dropped principally because it was realized that parts would not be available for five or six months. It is felt, however, that the Kaiser car should be in production after the first of next year. Meanwhile, a number of experimental Kaiser cars are under road test pending release for production.

Gar Wood Purchases Former Bendix Plant

Gar Wood Industries, Inc., has expanded its manufacturing facilities by purchasing from the War Assets Administration the former Bendix plant in Wayne, Mich.

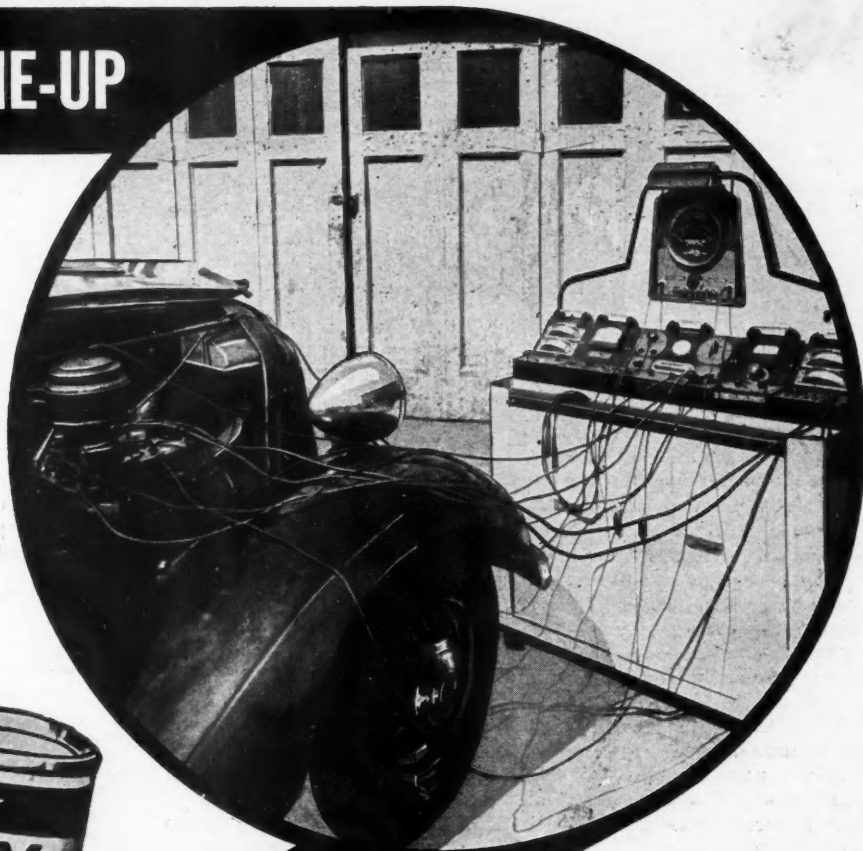
The company will transfer all its Detroit operations to the new site with the exception of its body plant which will remain on Connecticut Ave. When the new plant is in full operation, it is expected that Gar Wood employment in the Detroit area will rise to 3,500 from the present total of 1,500.

Chrysler Six-Pasenger Town and Country Sedan



Chrysler's new four-door, six passenger Town and Country sedan has a body built of woods left in their natural colors. The body members are of white ash and panels are of mahogany on plymetal, said to provide structural strength equal to that of the conventional steel body.

BEFORE YOU TUNE-UP



... USE THIS

FIRST, add PERMATEX TOON-OYL to crankcase oil to dissolve sludge and gum binders that interfere with the smooth operation of valves, piston rings, oil lines and oil screens.

THEN you'll have a **CLEAN ENGINE** ... ready for accurate mechanical adjustments!

PERMATEX COMPANY, INC., BROOKLYN 29, N. Y.

Rx

ADD 1 QUART OF
PERMATEX
TOON-OYL TO 5
OR 6 QUARTS OF
ANY TYPE OF
MOTOR OIL IN THE
CRANKCASE

PERSONALS

Recent Appointments Among Automotive and Aviation Manufacturers:

Ford Motor Co., Lincoln Div.—Neill S. Brown, General Superintendent.

Graham-Paige Motors Corp.—William B. Keen, Supt. of Farm Equipment Production.

International Harvester Co., Motor Truck Div.—L. W. Pierson, Asst. Mgr. of Sales, specializing on national and fleet account sales; R. M. Buzard, Asst. Mgr. of Sales, specializing on operational phases of the business.

Nash-Kelvinator Corp., Nash Motors Div.—William A. Keller, special service promotion representative.

Boeing Aircraft Co. and Boeing Airplane Co.—H. O. West, resigned as executive vice-president; H. F. Brown, Vice-President — Production Manufacturing; F. P. Laudan, Vice-Pres. in charge of experimental manufacturing.

Luscombe Airplane Corp.—James J. Brophy, elected Secretary-Treasurer.

Bendix Aviation Corp., Bendix Products Div.—George E. Stoll, General Manager; J. H. Quam, Asst. General Manager; Charles D. Manhart, Sales Manager.

The International Nickel Co., Inc.—Walter C. Kerrigan, Manager, Nickel Sales Dept.

Westinghouse Electric Corp.—W. O. Lippman, elected a Vice-President.

Westinghouse Electric International Co.—William E. Knox, President and General Manager.

The Timken Roller Bearing Co.—Richard C. Baker, Executive Assistant. General Electric Co., Resin and Insulation Materials Div.—Harry K. Collins, Manager; John C. Morris, Supt. of Manufacturing.

General Motors Corp., Allison Div.—O. T. Kreusser, Engineering Administrator.

Parker Appliance Co.—Fred E. Amon, Manager, Aircraft Sales; D. W. Holmes, General Sales Manager.

The American Coach & Body Co.—Clarence G. Wood, Manager of Sales Promotion.

Borg-Warner Corp., Norge Div.—Howard L. Clary, General Sales Manager.

Bearings Co. of America—Alfons Alven, elected President.

Morse Chain Co.—Frank M. Hawley, President and General Manager; Ray P. Johnson, First Vice-Pres. and Asst. General Mgr.

Marmon-Herrington Co., Inc.—Bert Dingley, retiring as President. David M. Klausmeyer is his successor.

Weatherhead Co.—B. R. Teree, Project Engineer in charge of aircraft development.

Thompson Products, Inc.—Edwin T. Syvertsen, General Mgr. of Service Div.

Lear, Inc.—Harry S. Jones, Asst. Chief Engineer, in Chg. of Research

and Development; Richard G. Leitner, Chief Electronic Engineer.

E. F. Houghton & Co.—Dr. James T. Eaton, Manager of Research; Henry H. High, Supt. of Philadelphia Oil Dept.

Indian Motorcycle Co.—George W. Young, Chief Engineer of tools and methods.

Bowser, Inc., Industrial Pump Div.—J. B. Trotman, manager.

Progressive Welder Co.—Clifford M. Manzer, Chief Engineer.

Plomb Tool Co.—Carl W. Coslow, Vice-Pres. in Chg. of Manufacturing. Edo Aircraft Corp.—Noel B. McLean, Executive Vice-Pres.

E. W. Bliss Co.—Marshall M. Smith, elected Vice-Pres. and Director.

Driver-Harris Co.—George A. Lennox, Vice-Pres. in Chg. of Sales and Joseph B. Shelby, Asst. Vice-Pres.

American Foundry Equipment Co.—Kenneth H. Barnes, Chief Engineer; Chalmers R. Cline, Engineering Asst. to the President and Sherill S. Deputy, Asst. Sales Mgr.

Wagner Electric Corp.—F. F. Simon, Vice-Pres. and Controller; G. A. Waters, Vice-Pres. in Chg. of Manufacturing and K. M. Coggeshall, Asst. Vice-Pres. in Chg. of Production and Purchasing.

Detrex Corp.—J. D. Hamacher, Plant Engineer.

Goodyear Tire & Rubber Co., Automotive Products Div.—Robert S. Smiley, Asst. Manager.

The General Tire & Rubber Co.—J. J. Goldie, Director of Administration.

Warren City Mfg. Co.—A. L. Carlson, Sales Mgr.; J. F. Anschuetz, Asst. Sales Mgr. and Albert Clements, Chief Engineer.

Aircraft Corp.—Ford C. McElligott, Adv. Mgr.

Weekly Production of Cars and Trucks in U.S. and Canada*

Week ending	1945	Corresponding Week in 1941
Jan. 5.....	13,920	76,699
12.....	23,340	115,935
19.....	28,465	124,025
26.....	29,410	121,948
Feb. 2.....	29,295	124,400
9.....	23,785	127,675
16.....	21,555	127,510
23.....	19,410	127,740
Mar. 2.....	17,575	126,550
9.....	23,050	125,915
16.....	35,020	131,410
23.....	37,285	123,805
30.....	43,070	124,165
Apr. 6.....	47,735	116,255
13.....	49,425	99,260
20.....	57,565	99,945
27.....	64,620	108,165
May 4.....	67,060	130,610
11.....	71,335	132,380
18.....	48,565	127,255
25.....	53,020	133,560
June 1.....	31,895	106,395
8.....	43,175	133,645
15.....	50,206	134,682
22.....	54,475	133,565
29.....	64,015	127,926
July 6.....	46,810	96,457
Totals....	1,040,606	3,257,868

* Compiled by Ward's Automotive Reports.

Dodge Chicago Plant Leased by Tucker Corp.

Following the resignation of Ray Rausch, former Ford production chief, Eugene Reason, former purchasing agent for Chrysler, and Joe Burke, one-time truck sales manager for Dodge, from Tucker Corporation, industry observers were busy measuring a coffin for the newly formed company. However, word now comes from the War Assets Administration that the Tucker interests have leased the 80-acre, \$170 million Dodge Chicago plant for a period of five years.

Rental terms, according to WAA, call for a payment of \$600,000 for the first year, \$800,000 for the second, and \$2,400,000 annually for the ensuing three years of the lease. The lease also carries an option which gives the Tucker firm the privilege of buying the plant outright within 4½ years of the lease term for a purchase price of \$30 million.

Real property of the plant consists of 475 acres with new concrete and brick buildings containing approximately 6½ million sq ft of floor space, of which about 4 million are suitable for assembly purposes.

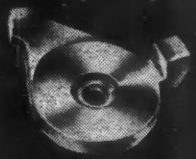
The agreement also provides that the Corporation may lease selected machinery and machine tools from the approximately 8,000 items now in the plant and the remainder will be removed at government expense. Machinery engaged on a rental basis may also be purchased by the firm at any time during the life of the lease. Included among the equipment are:

An aluminum and a magnesium foundry on the site, 18 aluminum tilting melting furnaces with 30,000 lb capacity, and 3 remelting furnaces (25,000 lb per heat) with a rated annual capacity of 24 million lb of aluminum castings. The rated capacity of the magnesium foundry is 18 million lb per year.

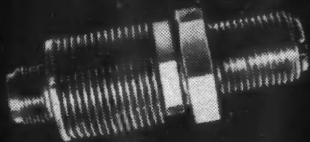
Also, there are 48 forge furnaces, 40 steel hammers up to 35,000 lb, 44 presses with from 100 to 900 tons capacity and 32 steel-cutting saws.

Additional equipment includes 7,670 items such as boring, drilling, broaching and forging machines, grinders, lathes, planers, shapers and presses; 3,520 items such as wire brushes, chucks, cranes and drills; 1,721 items such as tanks, squares, decreasers, wheel formers, coil winders, torque testers, etc.; 204 items of metal forming and sheet metal tools and machines including rolling, grinding, etc.; and other miscellaneous items.

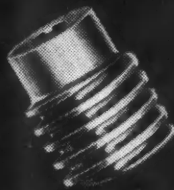
Preston Tucker, Ypsilanti, Mich., designer and president of the company, has announced that production of his Torpedo car, a six cylinder lightweight model, will start six months after the plant is occupied. Identity of the financial interests backing the company has not been announced.



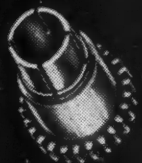
CLOSE TOLERANCES ($\pm .0001''$) and the need for easy, low cost machining called for Carpenter Stainless No. 5 bar stock on precision parts for the Norden bombsight



FREE-MACHINING Stainless Steels were invented by Carpenter. And easier machining reduces rejects, cuts costs on jobs like this finned spark plug.



FEWER REJECTS on your precision jobs like these torpedo mechanism parts will mean lower unit costs, as well as improved performance for your products.



Improve PRODUCT PERFORMANCE Lower YOUR UNIT COSTS

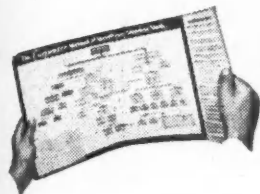
where you use *Stainless Steel!*

Even Stainless Steels of the same analysis aren't all alike. And the differences become most apparent when you start fabricating them. Where one Stainless will be troublesome to machine, another will cut freely.

The difference can be traced to the care and quality control that goes into the making of each Stainless Steel.

When Stainless is made under the rigidly controlled conditions of a tool steel mill only the finest quality can result. And that's just how Carpenter Stainless is made. When you add the advantages of Carpenter's pioneering research—Free-Machining Stainless Bars and ductile Stainless Strip—you have the most uniform, easy-working Stainless Steels available.

You can start now to reduce the cost of using Stainless ... by specifying "Carpenter" on your orders for Free-Machining Stainless bar stock. Standard sizes are available for immediate delivery from warehouse stocks. And don't hesitate to call in your nearby Carpenter representative. He can give you useful hints to help get jobs done at less cost.



... ANOTHER REAL HELP FOR STAINLESS STEEL USERS!

*A Handy Method for
Identifying Stainless Steels*

Even in the best regulated plants, steel stocks sometimes do get mixed. And you know the troubles a mix-up can cause in heat treating, machining, stamping, welding or other Stainless fabricating operations. To help you eliminate this problem, the Carpenter Laboratories have developed this chart which explains 8 different tests for identifying various types of Stainless. It shows when and how to use each test. To obtain a copy, simply send us a note on your company letterhead. Write today.

THE CARPENTER STEEL CO., 103 W. Bern St., READING, PA.

Carpenter STAINLESS STEELS



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Chicago, Cincinnati, Cleveland, Detroit, Hartford,
Indianapolis, New York, Philadelphia, Providence, St. Louis



CALENDAR

Conventions and Meetings

Institute of the Aeronautical Sciences,
Annual Summer Mtg., Los Angeles July 18-19
Municipal Airport Dedication & Sky
Show, Mansfield, O. July 20-21
1st Annual Revival Glidden Tour,
Albany, N. Y. Aug. 17-24
SAE Natl. West Coast Trans. and
Maint. Meeting, Seattle Aug. 22-24
National Air Races, Cleveland Aug. 30-Sept. 2
Natl. Aeronautic Assoc. of Canada,
International Air Show, Toronto Aug. 30-Sept. 7
Natl. Chemical Exposition, Chicago Sept. 9-13
American Chemical Soc., Chicago Semi-
Annual Mtg. Sept. 10-14
SAE Natl. Tractor Meeting, Milwau-
kee, Wis. Sept. 11-12
Instrument Society of America, 1st
Natl. Show, Pittsburgh Sept. 16-20
1946 Natl. Aviation Clinic, Oklahoma
City Oct. 14-17
SAE Natl. Transportation and Mainte-
nance Meeting, Chicago Oct. 16-17
American Society of Body Engineers-
Technical Mtg., Detroit Oct. 23-25
SAE Natl. Fuels & Lubricants Mtg.,
Tulsa Nov. 7-8
Natl. Aircraft Show, Cleveland Nov. 15-24
American Welding Society Annual
Meeting, Atlantic City Nov. 17-22
Natl. Metal Congress and Exposition,
Atlantic City Nov. 18-22
SAE Natl. Air Transport Engineering
Mtg., Chicago Dec. 2-4
Natl. Standard Parts Assoc. Conven-
tion, Atlantic City Dec. 6-7
Automotive Service Industries Show,
Atlantic City Dec. 9-14
International Aviation Celebration &
Exhibition, El Paso Dec. 12-15

News of the Industry

(Continued from page 42)

help it for several reasons. Rank and file support may not be as great as supposed for one thing. Also, Reuther's leadership of the G.M. strike was not notably successful and many of the workers know it. Another consideration is that labor unions narrowly escaped restrictive legislation during the recent wave of strikes and another series of big stoppages that shut off production might bring a revised version of the Case Bill out for another attempt at corrective legislation. It must be remembered, too, that even before OPA was thrown out, prices were climbing and that the public generally is getting wise to the fact that it was due primarily to big wage increases touched off by the UAW-CIO. So, while the union will strike if need be, the outlook is for some window dressing and shadow boxing before the men actually are called out, unless the leaders lose control of the membership.

Wage Strike Would Present Dilemma to Industry

If the announced plans of the unions to strike for higher pay if OPA is not restored in suitable form materializes, the automobile companies would face an almost insoluble dilemma. On the

one hand, to increase wages at a time when they are operating at a loss because of previous wage hikes would appear to be almost an economic impossibility without a corresponding boost in car prices. It is true that they are not now held to ceilings by OPA and that they could legally raise prices enough to cover the increased costs. However, with prices already far above 1942 levels, any further increase would be risky indeed so far as volume sales is concerned. The only hope is that living costs generally will stay reasonably well in line, forestalling a wage drive at this time, or that organized labor will pull in its horns and give prices a chance to settle down before demanding wage hikes.

July Production Prospects Show Improvement

With the return of all automobile companies to production, July promises to be the largest month, production wise, of any since reconversion started. June was a distinct disappointment, with an estimated 214,000 vehicles turned out, a drop of more than 33,000 from May. However, predictions for July show that it is altogether likely that production will top the 300,000 mark with little difficulty, barring any unforeseen trouble. The industry rounded out its first full year of production, dating from July 3, 1945, when Ford started output, with a total of about 1,141,000 cars and trucks, of which 1,056,426 were turned out in the first half of 1946. The most optimistic estimates now hold that another 2.6 million cars can be built the last six months of this year for a 1946 total of about 3.6 million. Here again, however, the estimate presupposes continued improvement in parts supplies and little labor trouble. If strikes resulting from increased living costs should materialize, the results could be very depressing indeed.

Production Figures to Date Make Sorry Showing

From two sources in the automotive industry come figures to show that output of cars since V-J day make a sorry picture when compared with either the period after the last war or with that just prior to World War II. According to AMA, present production, in spite of greatly increased capacity and much superior tooling and production techniques, is far less than it was during the nine-months period following the armistice in 1918. From Sept. 1, 1945, to June 1, 1946, the industry delivered to dealers only 581,691 cars. In the period from Dec. 1, 1918, to Sept. 1, 1919, it delivered 1,073,210 cars. In a comparison of General Motors production for the first six months of 1946 with the same period in 1941, C. E. Wilson, president, pointed out that in the first half of this year, production of G.M. cars was 165,746 units, compared to 1,206,479 in the same period

of 1941. For trucks during the same periods, production was 83,761 and 226,758 respectively. June production this year was 61,858 cars, against 203,544 in the same month of 1941.

Business in Brief

Written by the Guaranty Trust Co., New York, Exclusively for AUTOMOTIVE and AVIATION INDUSTRIES

Sustained recovery of general business activity is indicated. The New York Times index for the week ended June 22 stands at 132.9, as compared with 131.6 for the preceding week and 140.2 a year ago.

Sales of department stores, as reported by the Federal Reserve Board, for the week ended June 22 equaled 247 per cent of the 1935-39 average, as compared with 283 in the preceding week. Sales were 35 per cent above the corresponding distribution in 1945, as against a like advance of 37 per cent for the week before. The total in 1946 so far reported is 27 per cent greater than the comparable sum in 1945.

Electric power production increased by more than the usual seasonal amount during the week ended June 22. The output was 5.3 per cent below the comparable amount last year, as compared with a similar recession of 7.3 per cent in the preceding week.

Railway freight loadings during the same week totaled 853,437 cars, 1.1 per cent less than the figure for the week before and 2.1 per cent below the corresponding number a year ago.

Crude oil production in the week ended June 22 averaged 4,949,500 barrels daily, 11,150 barrels less than the average for the preceding week but 51,636 barrels above the comparable figure in 1945.

Bituminous coal and lignite production during the week ended June 15 was estimated at 12,140,000 tons, as compared with 12,780,000 tons in the week before and 11,746,000 tons a year ago. The output in 1946 so far reported is 23.2 per cent below the corresponding production in 1945.

Civil engineering construction volume reported for the week ended June 27 by Engineering News-Record, \$123,606,000, is 22 per cent greater than the figure for the preceding week and 176 per cent above that recorded a year ago. The total shown for twenty-six weeks this year is 200 per cent more than the comparable sum in 1945. The increase in private construction is 554 per cent, and the advance in public construction is 54 per cent.

The wholesale price index of the Bureau of Labor Statistics for the week ended June 22 is 112.4 per cent of the 1926 average, as compared with 111.8 for the preceding week and 105.9 a year ago.

Member bank reserves declined \$6,000,000 during the week ended June 26. Underlying changes thus reflected include a rise of \$450,000,000 in Reserve bank credit and a gain of \$469,000,000 in Treasury deposits with Federal Reserve banks, accompanied by an advance of \$19,000,000 in money in circulation.

Total loans and investments of reporting member banks declined \$757,000,000 during the same week. A rise of \$9,000,000 in commercial, industrial and agricultural loans was recorded. The sum of these business loans, \$7,529,000,000, shows a net increase of \$1,606,000,000 in twelve months.

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TRIES



**“.... to help make your
good engines even better”**

*Putting
inside bevel on
compression rings.*

SINCE 1911 it has been our proud privilege to work closely with leading engineers of the automotive industry in a continuing effort for improvement of engines. Sealed Power plants and the Sealed Power staff, always at the head of the field, are today the finest in our long history. Our laboratories, our engineers, our full resources are at your disposal now to help make your good engines even better.

SEALED POWER CORPORATION

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**Keep Your
Savings Bonds!
Get \$4 for \$3!**

SEALED POWER PISTON RINGS
PISTONS — CYLINDER SLEEVES

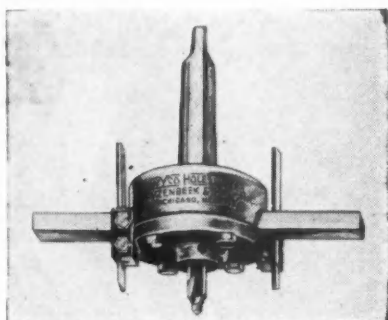
July 15, 1946

When writing to advertisers please mention AUTOMOTIVE and AVIATION INDUSTRIES

New Production and Plant Equipment

A HEAVY DUTY hole and washer cutter for production work, that cuts clean round holes or washers from steel plate, or other material up to ½-in. thickness, is the product of Wyzenbeek & Staff, Inc., 838 West Hubbard St., Chicago 22, Ill.

The new Wyco is said to cut as accurately to size as a boring tool. It fits 1-in. drill chuck, or can be supplied



Wyco hole and washer cutter

with Morse taper shank. Tool holders and body are of heavy steel, and are extremely rigid.

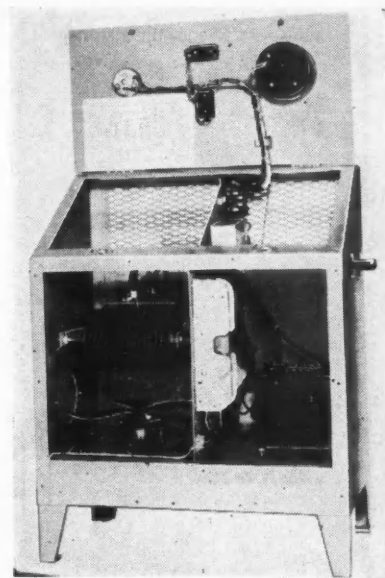
Balanced cut is insured by two standard high-speed cutting-off blades. Pilot pin is ½-in., hardened. Shanks are interchangeable. The tool is furnished complete with ⅞-in. hexagon shank to fit any 1-in. drill chuck, or

with No. 3, or No. 4 Morse taper shanks. Extra blades, correctly ground, are also available.

ON-THE-SPOT charging of batteries, thus eliminating the need for a central charging area, is possible with a selenium battery charger brought out by Automatic Transportation Co., 149 W. 87th St., Chicago 20, Ill. The selenium charger is designed exclusively to charge batteries for the Transporter, Automatic's motorized hand truck.

Completely automatic, the unit is said to enable untrained personnel to charge batteries from electric outlets by connecting the battery to the charger and setting the time clock. The clock regulates length of charge and automatically terminates the charge. Battery temperature well below the maximum permitted by manufacturers is maintained throughout the charging period.

The chargers are available for operation from three standard a-c lines—110-115 volt 60 cycle single phase, 220-230 volt 60 cycle single phase, and 110-115 volt 25 cycle single phase.



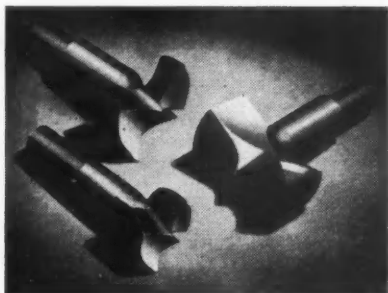
Selenium battery charger made by Automatic Transportation Co.

SNYDER TOOL & ENGINEERING CO., 3400 E. Lafayette St., Detroit 7, Mich., has designed a special-purpose machine for rough and finish boring of compressor casings and cylinders through a wide variety of sizes. While primarily intended for dry work on cast iron, provision is made in the base for the use of coolant if that necessity should develop.

The machine consists, essentially, of a special welded steel base upon which are mounted two Snyder hydraulic column and platen assemblies and a manually-operated index table operating upon anti-friction bearings.

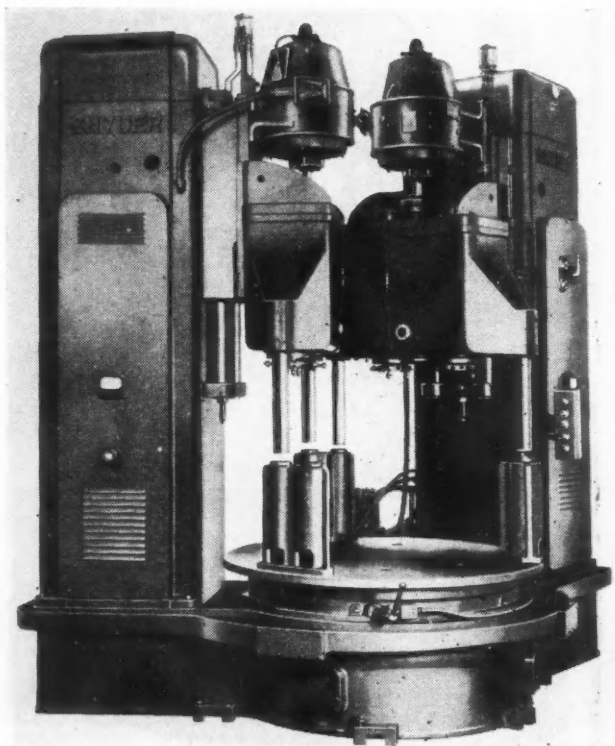
(Turn to page 86, please)

Drills for Metals and Plastics



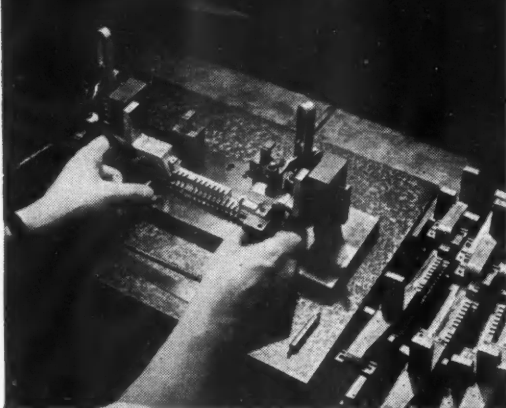
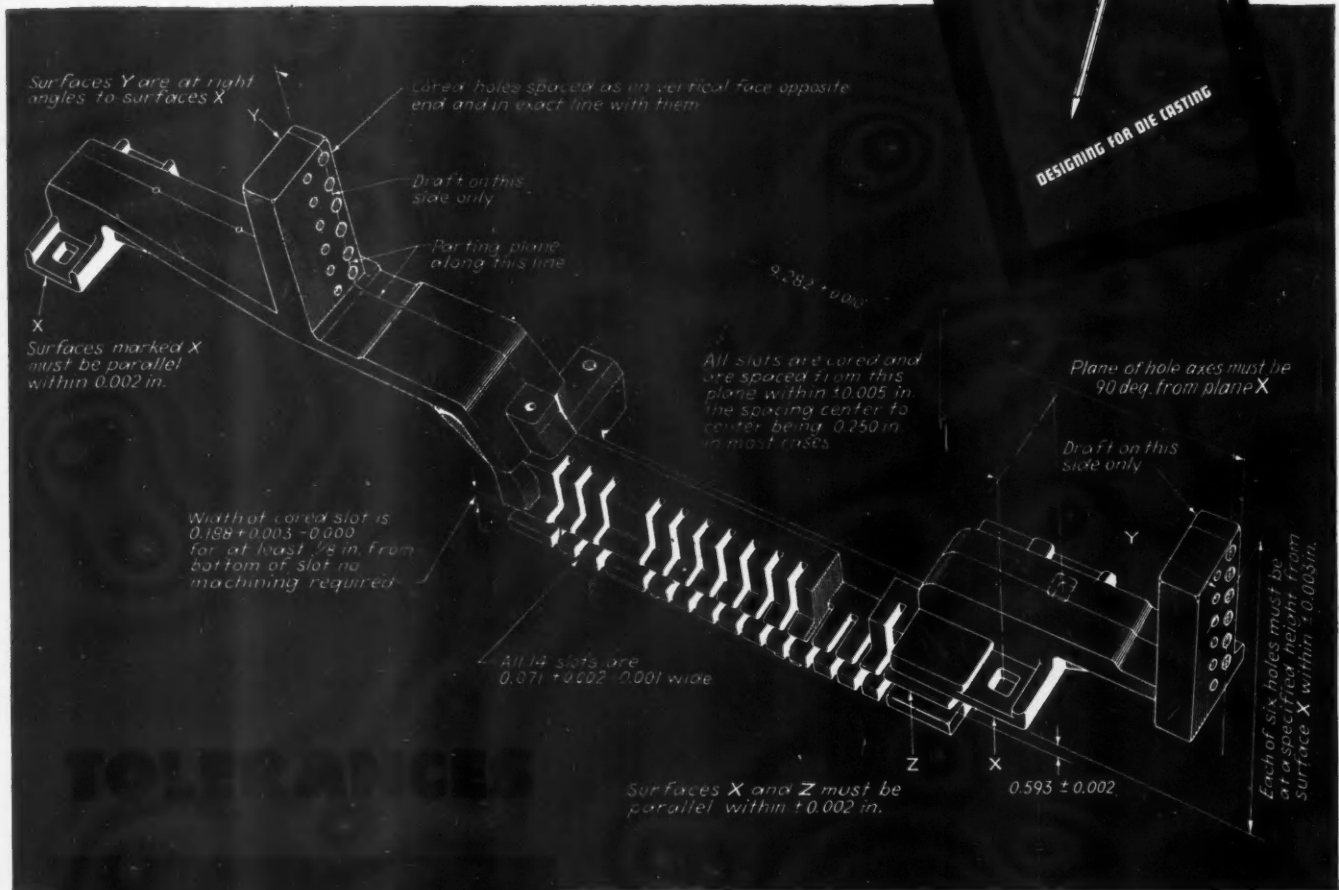
These Barco Micro King mill-drills, made by Barco Machine Products Co., 1975 E. 65th St., Cleveland, Ohio, are said to be suitable for drilling all types of metals and plastics. They may be ordered singly or in sets of 16 in the following sizes; ⅛-in. dia. through 2-in. dia. by eighths, or 1/16-in. dia. through 1 15/16-in. dia. in 1/16-in. sizes. These mill-drills are adapted for use also with portable drills, depending upon the diameter.

Snyder special-purpose machine



DESIGNING FOR DIE CASTING

SEND FOR
YOUR
COPY



In designing die castings, *never specify tolerances closer than are essential to meet requirements* since it may cost much more to hold close dimensions than to allow them to come within somewhat wider limits.

Where close tolerances are essential, however, the die casting process is capable of doing a quite remarkable job. An outstanding example is the above zinc alloy die casting used in communications equipment. The tolerances shown on the drawing are all as-cast—and all critical holes are cored to tapping size! Each casting is checked in the special fixture illustrated to make certain that all dimensions are within the limits specified.

For zinc alloy die castings, the *minimum* tolerance—as-cast—is usually $\pm .001$ per inch where the dimension is within solid parts of the die not having relative motion. Where the dimension is across a parting, or between parts of the casting formed by movable cores or slides, wider limits should be specified or provision for machining must be made.

Additional data on tolerances and other design considerations will be found in our booklet "Designing For Die Casting." To insure that you will get the most from your die casting dollar, ask us—or your die casting source—for a free copy of this booklet.



FOR DIE CASTING ALLOYS

THE NEW JERSEY ZINC COMPANY, 160 FRONT ST., NEW YORK 7, N. Y.

The Research was done, the Alloys were developed, and most Die Castings are based on
HORSE HEAD SPECIAL (99.99+% Uniform Quality) ZINC

Controllable Pitch Propeller

(Continued from page 25)

absorbed from the engine. In most cases the airplane is not equipped with a manifold pressure gage or the manifold pressure gage readings were disregarded and the pilot simply operated at a given propeller speed regardless of the pitch setting of the propeller or the power delivered by the engine.

For example, if we refer to Fig. 1, which represents a full throttle and a family of propeller load curves for a typical small airplane engine, it can be seen that if the pilot selects a cru-

ising speed at a propeller speed of 2300 rpm and he has available a multiple pitch or constant speed propeller, that he can absorb power having any value from the rated cruising power of 62 hp equivalent to a manifold pressure of 24.8 in. of mercury (point C, Fig. 1) up to the full throttle power of 76 hp at 2300 rpm (point D of the same figure). If he operated at point D he would be using 14 more horsepower than that permissible under the guaranteed cruising power and would show

a cruising speed seven per cent higher than that at permissible cruising power. At 120 mph this would represent an increase in speed of about 8½ mph. It is obvious, however, that this speed also represents the maximum full throttle speed of the airplane at 2300 rpm. This factor will be discussed in more detail later in connection with fuel consumption and range.

However, in the case of airplanes of new design in which the wing area and other proportions of the airplane can be adjusted to take full advantage of the controllable pitch propeller, it is entirely possible to obtain an appreciable increase in level flight performance. In such cases the take-off distance and the rate of climb will remain nearly the same as that of the airplane with the larger wing area, but the maximum speed and level speed will be increased. In other words, the controllable pitch propeller permits the use of higher wing loadings.

The maximum speed of an airplane can be expressed approximately by a simple formula as follows: (Ref. 3)

$$V_{max} = K \sqrt{\frac{P}{S}}$$

where

V_{max} = Max. level speed (mph).

P = Normal power rating (hp).

S = Wing area (sq ft).

K is a constant for a given type of airplane and according to Ref. 3 has a value of 150 for good average design, 185 for best modern practice and 250 for the case of zero parasite drag. The value of K increases with a decrease in wing loading. Ref. 3 provides formulas and charts for the proper selection value of K .

This formula provides a rapid means of determining the effect of reducing wing area on the level flight speed. The practical reduction in wing area to provide acceptable take-off and climb conditions has to be adjusted between this formula and those given for take-off and climb. This procedure has been used by all modern transport, military and higher performance personal type aircraft.

A quick estimate of the increase in speed can be obtained by the use of simple formulas, but it is recommended that the results be checked by use of the more accurate formulas or the plotting of actual performance charts. Fig. 6 shows the increase in speed which could be obtained by reducing wing area for a constant gross weight, a constant aspect ratio and constant rate of climb when the rate of climb is kept the same as that of a fixed pitch propeller by installing a controllable pitch propeller.

In the case where it is permissible to cruise at constant horsepower or constant manifold pressure with increasing altitude up to the critical altitude, the controllable pitch propeller makes such an operation possible and (Turn to page 54, please)



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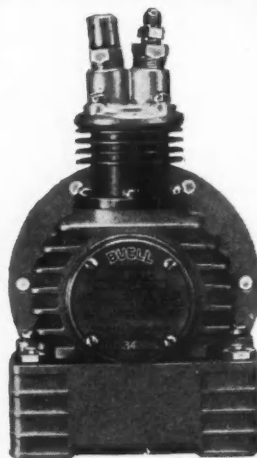
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results in an increase in cruising speed of about one per cent for every 1000 ft increase in altitude and a slightly greater percentage in the case of the constant manifold pressure operation. For example, if the sea level cruising speed is 120 mph and the critical altitude of the engine at permissible cruising power is 5000 ft, then there will be an increase of five per cent in the cruising speed at constant cruising power and at 120 mph this would result in an increase in speed of six mph.

Seaplane Applications

The controllable pitch propeller can

be designed to provide reverse thrust to improve the water handling characteristics of a seaplane or an amphibian.

Operating Precautions

The simple two-position controllable pitch propeller offers very few difficulties or added operations for the average pilot. Most of the controls are very simple and the pilot simply sets the control for take-off when the engine is being warmed up on the ground and places the control in normal position after the airplane has reached a safe altitude. Such a control can be made to operate in the same manner as the

throttle, that is the control is pushed in for take-off and pulled out for normal operation.

In the case of multiple pitch and constant speed propellers it is highly essential that the airplane be equipped with a manifold pressure gage and that the operator be instructed to correlate the manifold pressure readings and the propeller speed readings in order not to exceed the maximum permissible guaranteed cruising power of the engine. There have been a number of cases in which pilots using these types of propellers have operated at a power output sufficiently in excess of the guaranteed values to be unable to complete their flight due to the fact that all of the fuel had been exhausted. The same also applies to the oil consumption, and flights may be terminated due to excessive oil consumption caused by the higher amount of power absorbed from the engine.

If we consider the previous example discussed under Cruising Speed, it can be seen that if a pilot operated at cruising conditions of 2300 rpm and a pitch setting to result in either full throttle or nearly full throttle, that, for a given endurance of flight, he would be consuming at least 23 per cent more fuel and oil for an increase in speed of only seven per cent. Consequently, if he intended to fly for the same number of hours as he was accustomed to with the fixed pitch propeller, he would exhaust his fuel supply before reaching his destination.

As a specific example, for a fuel capacity of 20 gal there would be an endurance of 3½ hr at 120 mph, which would give a range of 420 miles when operating at point C, and an endurance of 2.86 hr and a range of 368 miles when operating at point D. Consequently, although the speed is increased the cruising range is reduced considerably.

References

1. Engineering Aerodynamics by W. S. Diehl (Ronald Press).
2. National Advisory Committee for Aeronautics, Technical Report No. 450, "The Calculation of Take-Off Run" by W. S. Diehl.
3. Airplane Design by E. P. Warner (McGraw-Hill Book Co.).

AIEE Elects Officers

J. Elmer Housley, district power manager, Aluminum Co. of America, Alcoa, Tenn., was elected president of the American Institute of Electrical Engineers for the year beginning August 1, 1946, as announced at the annual meeting of the Institute held in Detroit. The other officers elected were: vice presidents E. W. Davis, Cambridge, Mass.; O. E. Buckley, New York, N. Y.; T. G. LeClair, Chicago, Ill.; R. F. Danner, Oklahoma City, Okla.; C. F. Terrell, Seattle, Wash., directors J. F. Fairman, New York, N. Y.; R. T. Henry, Buffalo, N. Y.; E. P. Yerkes, Philadelphia, Pa., treasurer W. I. Slichter, Schenectady, N. Y. (re-elected).

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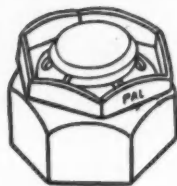
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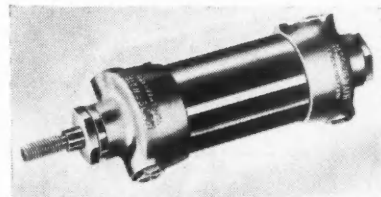
Designed to permit a diversified use of the same cylinders, Modernair cushion cylinders with interchangeable mounting means are now being mar-

keted by Modernair Corp., 4222 Hollis St., Oakland 8, Cal. No tie rods are used, and a design feature permits the cylinder caps to rotate 360 deg.

Another feature is the use of aircraft type "O" ring packings through-

out the cylinder at all points of wear or possible leakage. No metal-to-metal contact exists at any point of wear. The cylinder is completely renewed by replacing these "O" rings.

The cylinder is corrosion resistant, and may be used for actuation by air, water or oil. The standard design incorporates a self-regulating cushion; however, an adjustable cushion can be furnished. Cylinder caps are designed to take one of several available brackets or any possible combination of brackets.



Modernair cylinder

These mounting brackets are essentially an end plate, foot bracket and swivel mounting. Various combinations are possible to suit the requirements of multiple installations.

Modernair cylinders are available in 2-in., 3-in., 4-in., 5-in., and 6-in. diameters.

Texaco Announces Star Grease No. 0

For factory lubrication of tractor track rollers and other applications requiring a soft, water-repellant, non-separating grease, The Texas Co., 135 E. 42 St., New York, N. Y., has developed Texaco Star Grease No. 0. Made with lime soap, this product is said to be heat stable and resistant to both water and oxidation.

Low Inertia Motor for Remote Control

A compact, 60-cycle, two-phase, low inertia motor for remote control applications has been developed by Transcoil Corp., 114 Worth St., New York, N. Y. Designated as Model 2A Servo-Motor, this unit does not run single phase and the fixed phase may be continuously energized. It can be wound (Turn to page 58, please)



Transcoil motor

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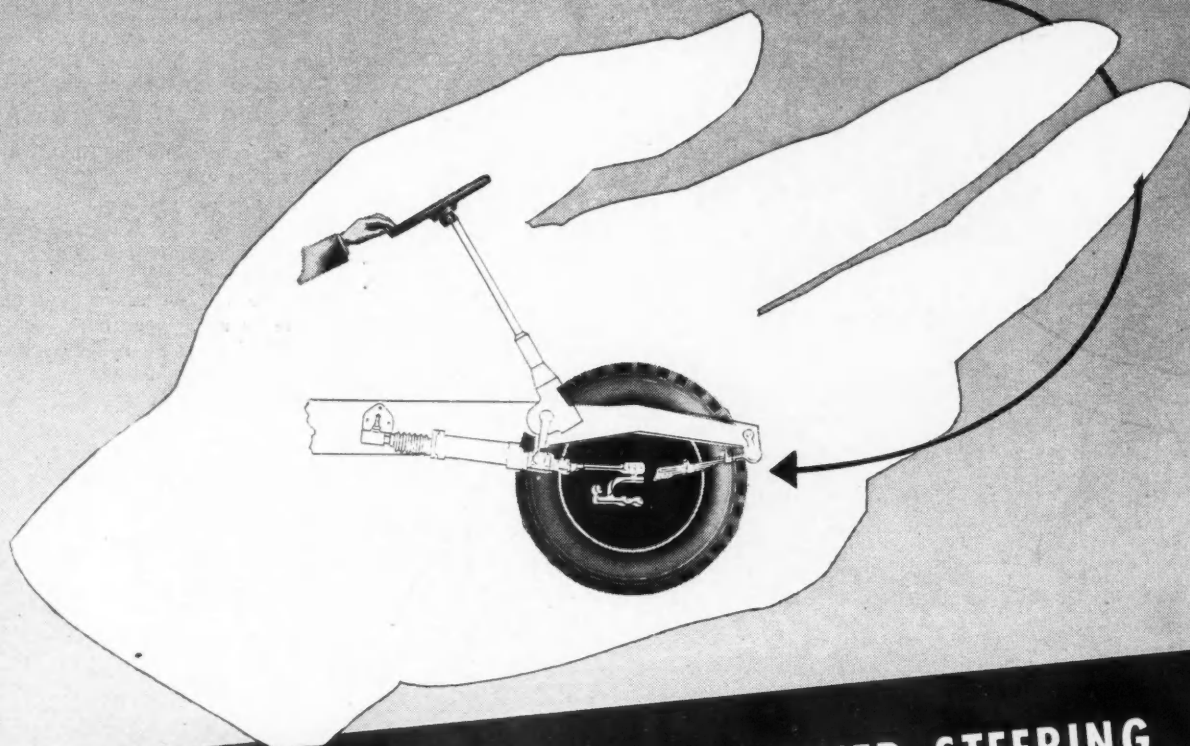
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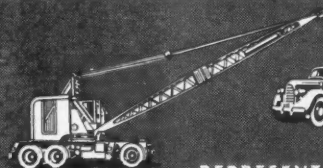
Two fingers on the steering wheel—it turns easily, and the front wheels of the heaviest truck or bus follow exactly. Vickers Hydraulic Power Steering does the work. And steering is just as easy over the roughest ground off the road as it is on smooth concrete. Road shock cannot be transmitted from the front wheels to the steering wheel or driver.

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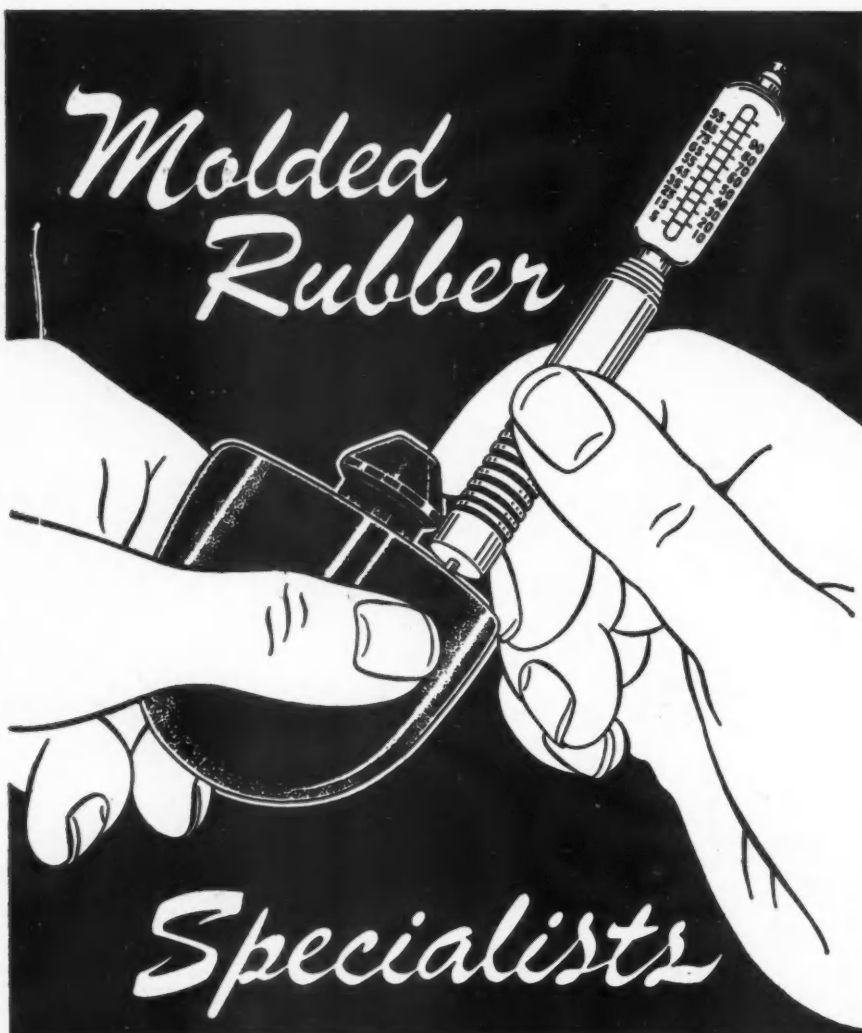
most exhausting part of his job, enabling him to get more done with less fatigue.

Vickers Hydraulic Power Steering has many other advantages: (1) requires minimum space and is applied to most existing hand steering mechanisms with a few simple alterations; (2) automatic protection against abuse and excessive steering reaction forces; (3) automatic lubrication; (4) 15 years of successful operating experience. Ask for Bulletin 44-30.

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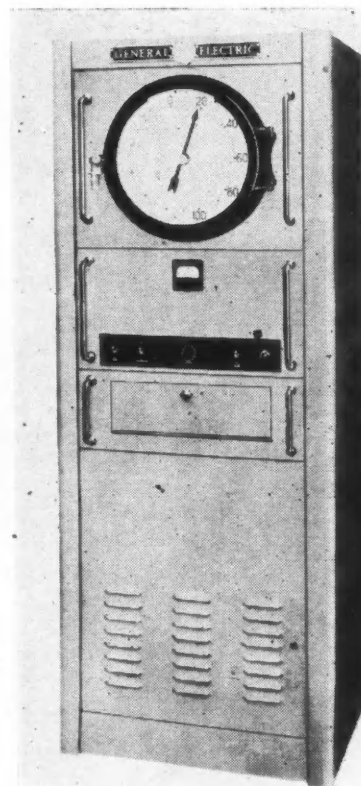
to operate from 10 to 80 volts, or more; 60 cycles.

Impedance is practically constant from full speed to stall, and the standard stall torque, 1½ oz in. can be changed as required. Stack length may be changed plus or minus 50 per cent to suit torque requirements. This will change the overall length a maximum of ⅜ in.

The Servo-Motor is furnished with separate leads for each phase, and a terminal board may be attached to rear of motor, if required.

Instrument Records Humidity of Gases

A dewpoint recorder which can determine automatically and continuously the amount of moisture in a gas has been announced by the General Electric Co., Schenectady, N. Y. The new instrument is designed for applications where the moisture content of atmospheres and gases must be measured or controlled, such as in checking furnace atmospheres, testing city gas, or de-

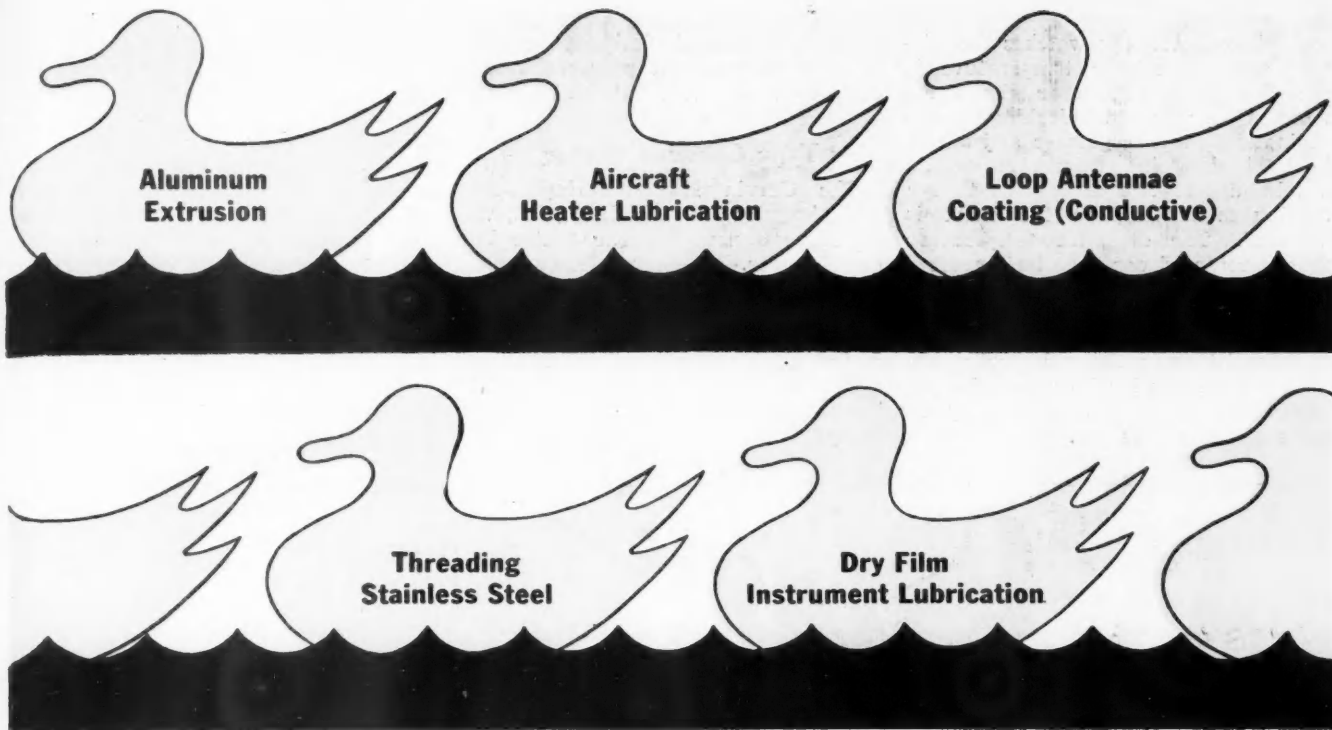


G-E dewpoint recorder

termining the humidity of gases used in factory production processes.

The new dewpoint recorder is a combination of heater, refrigerator, mirror and gas chamber. The test gas enters the gas chamber and comes in contact with a metal mirror. The refrigerator and heater cool or heat the mirror until a temperature is attained at which moisture in the gas forms dew on the mirror.

(Turn to page 60, please)



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The five birds in this gallery are only a few from the flock you can bring down with "dag" colloidal graphite dispersions.

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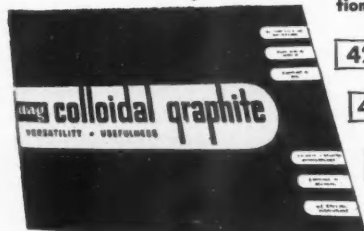
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A photoelectric eye watches the mirror, and the mirror temperature is recorded on a graph, or chart, the moment dew forms. Working in coordination, the refrigerator and heater hold this dewpoint temperature within a tolerance of two degrees so that a continuous reading on the chart is achieved. The dewpoint temperature that is recorded can then be converted into the moisture content of the gas if desired. The recorder can be arranged so that it will flash or sound a warning when moisture in the gas reaches too high or too low a level, or control other equipment which will dehumidify or add moisture to the gas.

The instrument is designed for operation at atmospheric pressure over a dewpoint range from ambient to -90 F.

New Type Gasoline Heater

The Garvin Manufacturing Corp., 4545 Augusta Blvd., Chicago, Ill., will introduce a new-type car heater late this summer. Company officials assert that the new Motorola gasoline heater represents a radical departure from current automobile heater design and incorporates many exclusive features.

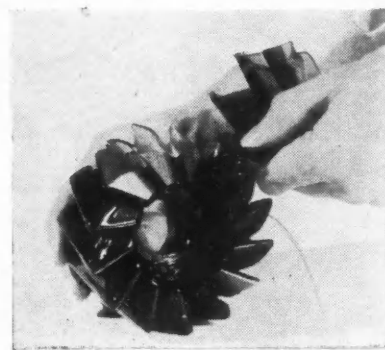
The Motorola Car heater operates independently of both engine and fuel pump, so that it *heats even when the*

engine is off. The driver can select the exact heat desired simply by pushing one of the buttons marked 50, 60, 70 or 80 deg. Once the heat has been selected by push button, it is maintained at that level constantly by a sensitive thermostat control. Heat is said to be produced in 33 seconds—even at temperatures as low as -50 F.

The new heater will be made in two models, one mounting on the cowl, and one mounting under the front seat. Both will be push button controlled from the dash.

Cutting Tools Protected During Shipment

Barber-Colman Co., Rockford, Ill., is now protecting cutting tools during shipment by coating them with Protecto-Coat. *Protecto-Coat* is a trans-



*Cutting tool coated with *Protecto-Coat*

parent, amber colored cellulose compound. It provides a tough yet pliable coating for cutting tool surfaces. Because of its transparency it is unnecessary to remove *Protecto-Coat* until tool is to be used, thus protecting the cutting edges in storage, and furnishing convenience for handling. The coating is applied by dipping the tool into cellulose compound heated 350-375 F. Contact with the air causes it to set almost immediately into a tough yet pliable coating.

Diamond Lapping and Polishing Compound

Hyprez diamond compound is a new prepared abrasive said to contain only finely graded, pure diamond powders in a scientifically developed vehicle. The diamond particles are graded to definite standard specifications and are evenly distributed and permanently suspended.

The compound is recommended by the maker for many finishing operations of metals, sintered carbides, sapphire and other hard materials. Die and mold work, gage and instrument production, are some of the fields in which this compound is being introduced.

Hyprez diamond compound is available in a large variety of grades, each (Turn to page 62, please)

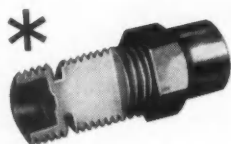
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identified by a distinguishing color. The compound is furnished in clear Pyrex cartridges which fit into syringe-type applicators.

Hyprez diamond compound is marketed by the Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill., and the Sapphire Products Div. of the Elgin National Watch Co., 932 Benton St., Aurora, Ill.

Protective Degreaser

Gaybex Corp., P. O. Box 3-D, Nutley, N. J., has released its ready-to-use emulsifying degreaser, G-Bex D for general distribution. G-Bex D is a neutral emulsifying solvent having a

minimum flash point of 165 F (ASTM C.O.C.). It is said to be non-irritating to the skin and is considered non-corrosive to all standard construction metals. G-Bex D will hot strip paint or lacquer and may be used for light or heavy duty degreasing by spray, brush or soak application followed by water rinse.

Flow Rate Meter for Purge Line Service

A small size Rotameter has been designed specifically for purge line (bubbler) service by Fischer & Porter Co., Hatboro, Pa. A die-cast unit so small it fits into the palm of the hand, this

meter is said to give accurate, precise flow rate measurement with minimum space requirement. It can easily be mounted in multiple on a panel. The Rotameter may be furnished with or without an integral needle valve.

Wages-Profits-Prices

(Continued from page 15)

wage costs since 1939. So we cannot be saved by volume.

Second, there is improvement in tools. Estimates of the improvement in the productivity of our tools run from 1.7 per cent per year to double that amount. Whatever figure is correct, it is clear that a great many years would have to pass before the accumulative gains arising from increased productivity in tools would be sufficient to offset the heavy increase in costs since 1939.

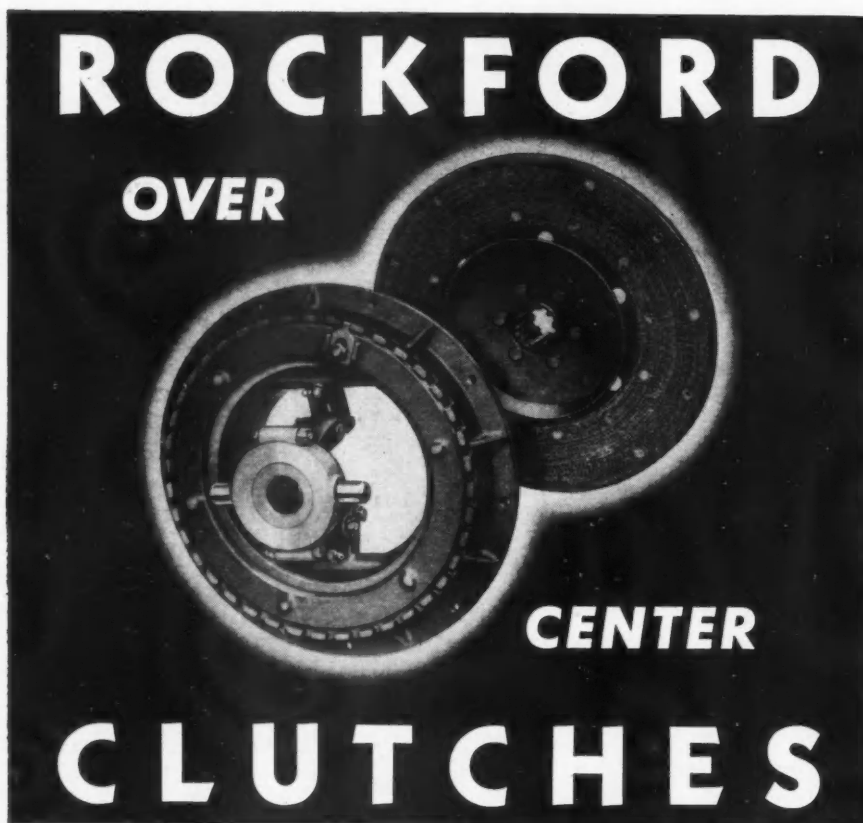
Third, there is price. It is clear that the wage rises have greatly exceeded the production required to offset them and hence must be covered in an abnormal price rise. But the first abnormal wage and price rises start waves of other increases and these come back at us in a higher price for the things we buy. You can see it coming today in coal, ore and freight and thousands of other items. All these combine to require further price increases.

And then where are we? We are on our way to the final squeeze by the customer—for the customer always has his own ceiling price. And we shall stay squeezed by King Customer until we adjust ourselves downward or the customer adjusts himself upward, neither of which can come about unless price and wage fixing be abandoned.

Government, of course, can intervene. But its intervention, except to prevent fraud and coercion, only makes things worse. For if the government or labor unions—assuming to supreme economic insight—introduce rigidity into our affairs, we shall be unable to adjust the exchange relations of our products to the exchange relations of other products out of which comes automatically self-balanced progress. That is why we cannot have a mixed economy. A mixed economy must always be a messed economy.

All government efforts to fix reasonable profits or to determine prices by profits or profits by prices are unalterably opposed to the American fundamental that producers must compete while competing customers—the public—decide.

All such government efforts are either open or disguised measures to protect the customer from himself. Actually the customer never needs protection—except in that ancient and continuing struggle to escape frustration and exploitation by government under the guise of protecting him.—*From an address before the American Iron and Steel Institute.*



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CENTER

CLUTCHES

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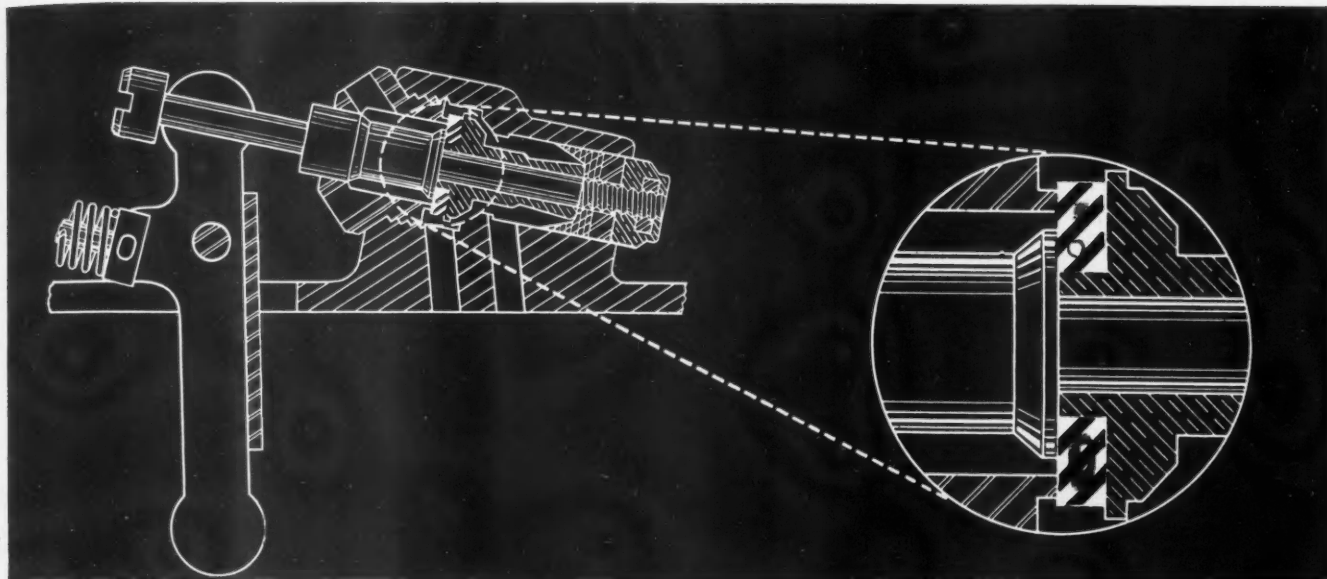
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Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.



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SEALING HIGH INTERNAL PRESSURES

Design factors affecting use of resilient materials

When sealing high internal pressures with resilient materials, assembly design must be governed by (1) characteristics of the gasketing material, and (2) conditions under which this material will function. For example, allowance should be made for possible change in volume of the resilient material when it is exposed to certain liquids and gases. Seating pressure, another important factor, should be kept well below that normal in all-metallic assemblies.

Choice of a sealing material depends upon the metal it will contact, the gas or liquid to be sealed, the degree of internal pressure, temperature range, and—for valve seats—seating pressure. Here the counsel of specialists is often valuable.

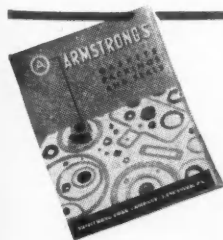
Typical of high-pressure sealing applications is a power grease gun. Internal pressure reaches 800 p.s.i.; operating speeds, 500 strokes per minute. Armstrong's DC-106, a cork-and-Neoprene composition, performs perfectly under these conditions. It doesn't swell appreciably. And it recovers quickly despite "machine-

gun" pounding. Under some operating conditions, one of Armstrong's Buna N compositions, NO-715, is also used successfully.

Where gasoline, fuel oil, and lubricants must be sealed, in nozzles and valves on handling and dispensing equipment, Armstrong's SC-600 and SC-601 are used. These two materials are compositions of Thiokol and cork. They have a low volume increase. Their cork content minimizes sticking and cold flow.

Minor design details often greatly influence the choice of a resilient sealing material. We suggest, therefore, that you discuss your sealing problems with an Armstrong Gasket Engineer before you set up your specifications. Behind his counsel is our 34 years of gasketing experience and our wide-range line of standardized resilient materials.

If you prefer, send us working drawings and details. We'll gladly give you unbiased recommendations. Either way there's no obligation.



SEND FOR FREE BOOKLET

For specification and application data on Armstrong's more than 50 resilient sealing materials, send for a free copy of the latest edition of "Gaskets, Packings, and Seals," twelve pages of helpful information. Address Armstrong Cork Company, Gaskets and Packings Department, 1507 Arch Street, Lancaster, Pennsylvania.

ARMSTRONG'S GASKETS • SEALS • PACKINGS



Cork Compositions • Cork-and-Synthetic-Rubber Compositions
Synthetic Rubber Compounds • Cork-and-Rubber Compositions
Fiber Sheet Packings • Rag Felt Papers • Natural Cork

Bond Testing of Silver-Plated Bearings

(Continued from page 33)

each group of bearings, the bearings being indexed between runs. Difficulties were encountered in whirling the massive arbor and in protecting the equipment in the event of a bond failure. Because other methods of checking ID plating became available, development of this type of arbor was suspended.

Although whirling is a practical production test method and has been in use for some time, its production rate is low because of the time required to

accelerate to the high test speeds. Also, failure of the silver on a bearing under test at these speeds may result in damage to the turbine or spindle.

By spraying brittle lacquer on the bearing prior to whirl-testing, it has been found that successful testing can be carried out at lower speeds. When the lacquered bearing is whirled at low speed, the silver on a badly bonded area lifts slightly, causing the lacquer to crack. Without the lacquer, it is necessary to whirl the same bearing

approximately three times faster to produce an actual silver blister. Unfortunately, available brittle lacquers are quite sensitive to oil, fingerprints, and changes in atmospheric humidity, and require a twenty-four hour drying period. The development of a stable, quick-drying lacquer is necessary before this technique can be used in production whirl-testing.

Shear Test

The shear test is a fast, economical method for checking silver bond at the edge of an as-plated part. The bearing to be tested is held in a jig and a blunt chisel forced against the overhanging edge of the plate (Fig. 5). The silver should be of sufficient thickness (0.008 to 0.010 in.) to provide stiffness so that a relatively large force can be applied to the silver before shearing it. Shear testing is suitable only for semi-finished parts.

Roll Test

Roll testing is essentially a roll peening operation suitable for use on semi-finished cylindrical parts. The device was developed by Ford Motor Co. for testing Double Wasp articulated rod pins. The pin is rotated between three rolls, two of which are power driven (Fig. 6). By means of weights and a lever system, the third roll applies a pressure to the part. After a 30 second test, small areas of poor bond will appear as shiny smears or as broken blisters while larger areas may be completely torn off the steel back (Fig. 7). The roll test has been successfully used on articulated rod pins, valve tappet roller pins, and counterbalance bearings.

Shot-Peen Test

Shot-peen testing is one of the most recent methods devised for checking silver plate adhesion. In England, A. W. Hothersall and C. J. Leadbeater first used the method for spot testing very thin plates (0.0001 to 0.002 in.). Their apparatus, however, was not adaptable to heavy plates or to continuous production inspection. The test was further developed at Pratt & Whitney Aircraft for production inspection of plates up to 0.025 in. thick. At this writing, it appears to be the most adaptable test available for checking silver adhesion.

The principle involved in the peen test is that the hammering action of the shot produces deformation of the silver. If the silver is poorly bonded and, therefore, unrestrained by the steel back, it will extend or flow and become blistered (Fig. 8). The intensity of peening necessary to cause non-adherent silver to blister varies with the plate thickness, thin plates requiring less than thick plates. Fig. 9 shows the approximate intensity required to raise blisters on silver plated steel where the adhesion is slight. (Turn to page 66, please)



Thousands of leading engineering, production and purchasing men know Grizzly as a dependable supply source for fine quality brake lining.

Engineering men recognize the "know-how" resulting from Grizzly's thirty years of engineering development and

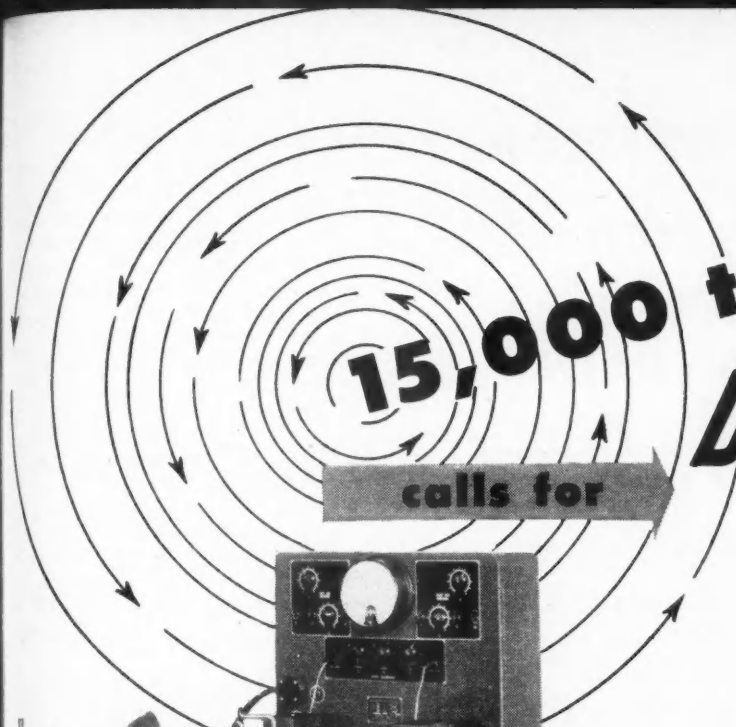
research. Production men acknowledge that Grizzly plants are ably manned and employ the most modern mass production techniques. Purchasing men know Grizzly as a reliable source for fine quality brake lining in the competitive price range.



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to 20,000 R.P.M. *Dynetric** **Balancing**

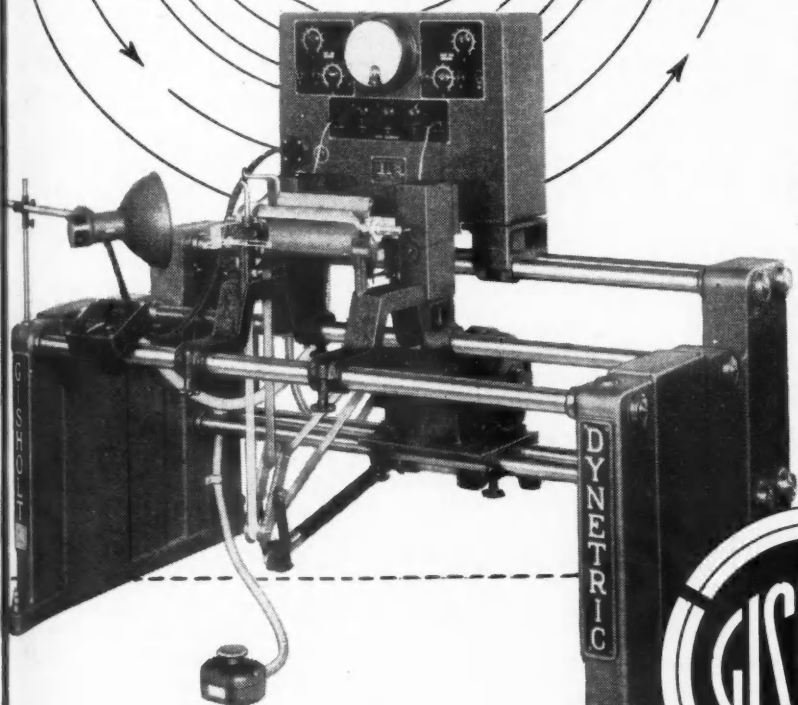
Here's another example of the way Dynetric balancing solves an operational and a maintenance problem at the same time.

These two photos show the mating members of a Diesel engine supercharger. Operating at terrific speeds as high as 15,000 to 20,000 r.p.m., even the slightest unbalance would cause destructive vibration and impair the efficiency of the unit. Still worse, it would result in bearing overloads and early bearing failure.

Thanks to the Dynetric principle, extremely accurate balance is made possible to eliminate vibration and insure long, trouble-free operation.

There are practically no limits to the size and weight of parts that can be handled—or to the degree of accuracy obtainable—with Dynetric balancing machines. If vibration, caused by unbalance in rotating parts, is one of your problems, Dynetric balancing will solve it quickly and at low cost. Write us.

**Developed jointly with the Westinghouse Electric Corporation*



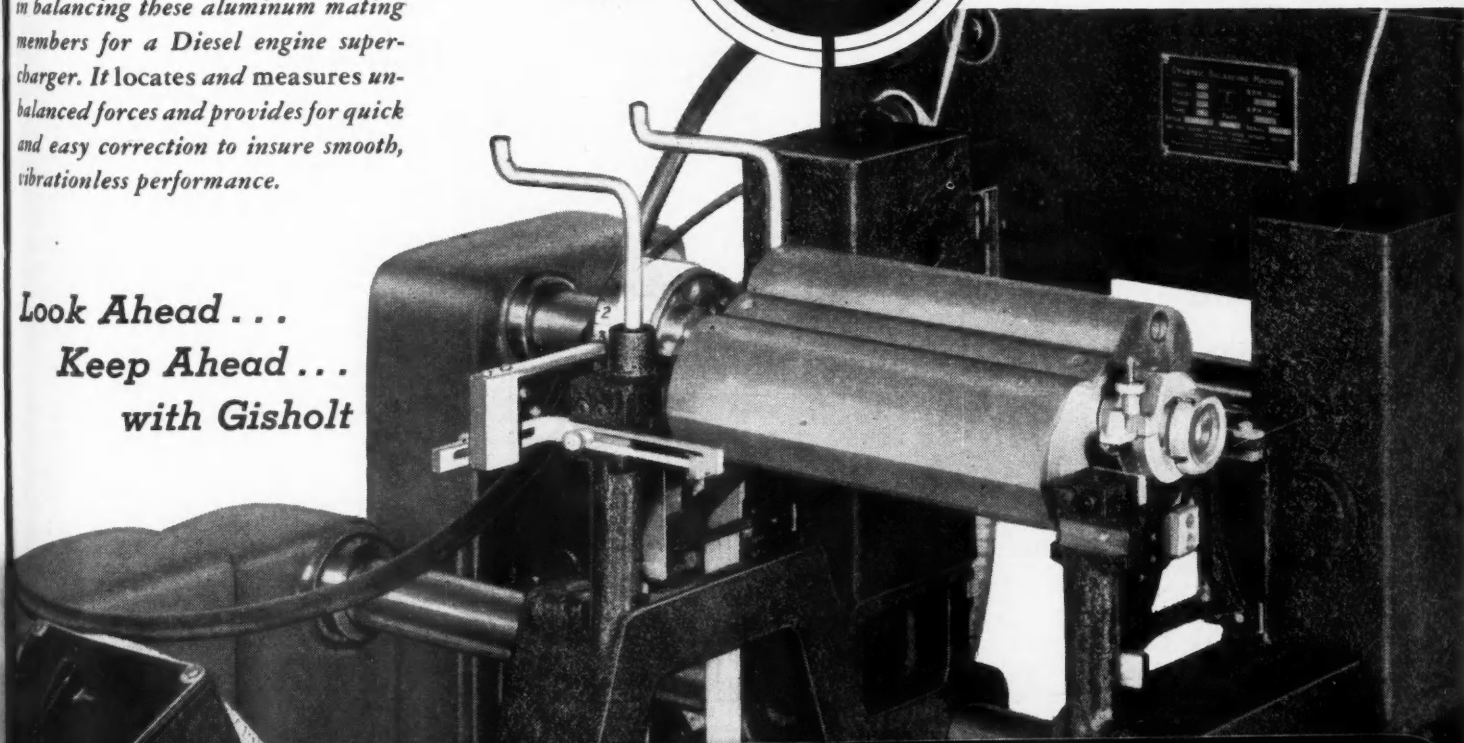
GISHOLT MACHINE COMPANY

120th E. Washington Avenue
Madison 3, Wisconsin

The Gisholt 3S Dynetric is used in balancing these aluminum mating members for a Diesel engine supercharger. It locates and measures unbalanced forces and provides for quick and easy correction to insure smooth, vibrationless performance.

Look Ahead . . .

**Keep Ahead . . .
with Gisholt**



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CLARK *will serve*
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CLARK FIELD ENGINEERS
can show you how to speed pro-
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freeing it for more skilled work.

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AXLES FOR TRUCKS AND BUSES • AXLE HOUSINGS • BLIND RIVETS
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METAL SPOKE WHEELS • GEARS AND FORGINGS • RAILWAY TRUCKS

Standard Almen "A" strips are used to measure the peening intensity.*

Parts are peen-tested in a standard air operated cabinet of the type used for shot-peening steel engine parts. Although glass beads, sand, and steel shot were effective in revealing lack of adhesion of plate, best results have been obtained with malleable iron shot. Masking is necessary to prevent peening of the unplated areas, and small oil holes must be plugged to keep shot from jamming in the holes. The shot should be kept clean and free from broken particles which may become imbedded in the silver.

The effects of peen-testing a silver plated bearing are two-fold: one, the silver surface becomes a region of small peaks and craters, and, two, slight work-hardening occurs to a depth of several thousandths of an inch.

Parts are shot-peen tested following the plating operation, in which customary practice has always been to electroplate silver at least 60 per cent thicker than the finished dimensions require. The surplus silver is removed when the bearing is machined to size. For example, a counterbalance bearing plated with 0.021 in. silver would have 0.010 in. silver machined off during finishing operations, more than enough to insure the elimination of all surface roughness and most of the work-hardened layer caused by peening. Shot-peening is the most adaptable of all the methods described in this paper, in that it may be used to test the entire silver plated surface of any part regardless of its size or shape provided only that the surface can be reached by a stream of air propelled shot. It is, however, limited to use on semi-finished parts. Investigation has shown that the method will detect only completely non-adherent plates. Intermediate adhesion values may pass undetected.

Other Methods

A number of other testing methods have been tried with little success. On the theory that a drop in silver resilience might accompany a bad bond condition, a series of tests were made with the Scleroscope. No correlation was found. Recently, however, another laboratory has reported some success in testing adhesion of babbitt by measuring the rebound stress in an air-operated repeating hammer. Physical properties unsuccessfully utilized in an endeavor to find improved adhesion tests include cross-sectional electrical resistance, thermal conductivity, and differential thermal expansion and contraction.

Conclusions

The choice of methods used for bond testing a given part depends upon its
(Turn to page 68, please)

* "Shot Blasting to Increase Fatigue Resistance," by J. O. Almen, SAE Journal, July 1943.

FLIGHT TESTING

COMBUSTION The Key to Flight Testing

T. S. BLAIR

Aviation Sales-Engineering

The oxygen and combustible gas content of airplane engine exhaust gases gives a true picture of engine conditions relating to the burning of fuel. They give the flight engineer a true indication of engine operating characteristics and can be interpreted to assist in obtaining maximum fuel economy or for operating at any predetermined condition.

The Cities Service Power Prover indicates continuously and simultaneously the percent by volume of oxygen and combustible gases in engine exhausts. These two combustible characteristics are indicated accurately over any range of fuel-air mixtures.

Theoretically, products of combustion bear a definite relation to the fuel-air ratio. In actual tests, however, due to variations in engine design and operation, the results do not necessarily conform to theory. Each engine has a definite pattern of the oxygen and combustible curve. Shown below is a typical curve taken in the laboratory. This curve will be duplicated in other engines of a similar design operating under the same conditions.

The first requirement for flight testing is a key for interpreting readings taken

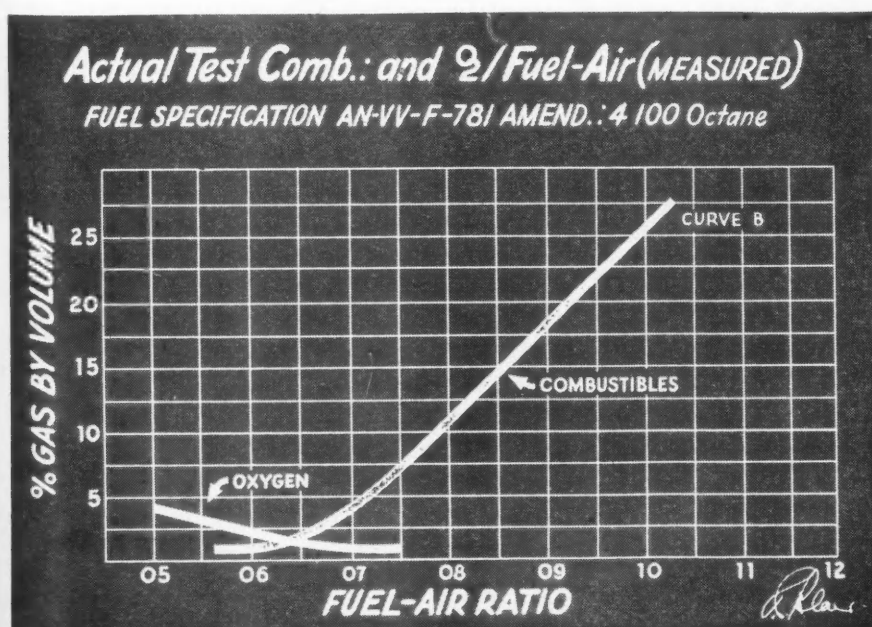


in the air. For combustion interpretations this consists of a curve obtained in a laboratory from a single cylinder engine (identical to the one under test in the air) using a similar fuel and operating under comparable load and speed conditions. Readings in the air should be taken from all cylinders as a further means of interpreting operating conditions. With this basic curve and a set of flight test readings a true picture is obtained relating to the burning of fuel.

The Power Prover is a unique, patented flight-test instrument operated by trained Cities Service aviation engineers. Used extensively by the Army and Navy, leading airlines and aircraft manufacturers, Power Prover flight-test service is made available by the Cities Service Oil Company, 60 Wall Tower, New York 5, N.Y.



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FOR THE
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shape, its size, and the thickness and location of the plate. Cylindrical parts with thin plates lend themselves best to roll testing. Pratt & Whitney Aircraft practice is to shear test parts having thicker plates, followed by either a whirl test or a peen test. The latter test, however, is replacing the whirl test because of its adaptability to any size and shape or part. In addition, peen-testing equipment is more economical to maintain and its production rate is higher.

By use of the methods outlined, silver plated engine parts can be produced with assurance that those which pass the tests will give satisfactory performance.

Chausson Small Car

(Continued from page 35)

hub rises. This gives very soft springing for small movements, the stiffening effect increasing with the rise of the hub. The lower wishbones and the attachment of the suspension tubes are all by means of steel stampings. Front and rear suspension are practically identical. Upholstery costs have been reduced to a minimum by use of a detachable frame for seat and back rests, with springs across it and imitation leather riveted on. The edges of the body, where two panels have been

welded together to form a box section are covered with a polished light alloy beading.

Use is made of a two-stroke, water cooled, single cylinder engine of only 350 cc., developing nine hp at 3700 rpm. A feature of this engine is that it is fitted with a new type Solex carburetor having neither float nor needle valve. Fuel is drawn from a gasoline tank immediately under the engine, by means of a pump and is delivered to a chamber in which the main jet is mounted, the excess gasoline being bypassed into the tank. Because of the lack of balance of a single cylinder engine a very special mounting is used, this consisting of a spring of a variable flexibility and rubber buffers. The clutch, transmission, and differential are separate from the engine and are mounted on rubber blocks, which are sufficient to damp out the vibration of the pinions, without interfering with the simplicity of the control gear. A single plate disk is used for the clutch. The transmission provides three speeds and reverse, while the differential has two satellites and the planetaries are used directly for driving the patented cardan shafts.

The Chausson is fitted with a canvas top, hinged at the rear and swinging back under a finger-tip movement to give access to the body. It is self locking. When desiring to use the vehicle as an open car, the top can be folded down completely.

Maximum speed is given as 48 mph, while gasoline consumption varies from 58 to 70 mpg (American), according to conditions. While prototypes are on the road, the date of production in France has not been fixed, owing to the uncertainty of supplies. It is possible that the car will first be produced under license abroad.

Truck Sales Increased During April and May

Registrations of new truck sales during April and May climbed sharply, averaging in April nearly 61 per cent of sales reported for similar states in the same months in 1941, and 77 per cent for May, according to R. L. Polk & Co.

New truck sales registered in 46 states during April amounted to 35,034, as compared with 57,489 in 1941, while registrations from 18 states for May showed a total of 11,497 truck sales, as compared with 14,165 for the same states in 1941.

The first national summary report on truck sales for the first quarter of 1946 (complete with the exception of the state of Vermont) showed a total registration of 87,022 trucks, as compared with 162,787 in 1941, the Polk motor statistical division announced.

CLEAN and BRIGHT



Write for this
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... And sparkling as a well-scrubbed tot—That's the way your parts come through with a Blakeslee Solvent Vapor Degreaser. No matter how small or large the part to be cleaned, you will find a tremendous saving in production because of the speed and thoroughness of a Blakeslee-built machine. Fifty years of "know how" enables us to answer your most complicated washing and degreasing problems. Let us tell you how.

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PLANT 4



PLANT 7



PLANT 6



PLANT 3



PLANT 2

Jack & Heintz
PRECISION INDUSTRIES, INC.
JAHCO

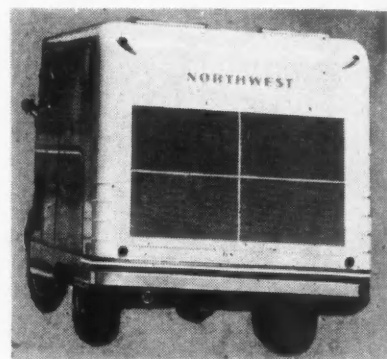
New Products for Aircraft

Air-Conditioning Unit

Clark Climate Control Co., 1326 Claybourn St., Milwaukee 3, Wis., announces the Clark Climate Controller, a mobile air-conditioning unit for aircraft. Whatever the outside tempera-

ture, the Clark Climate Controller is said to quickly bring the inside temperature of the plane to whatever degree desired for passenger comfort while the plane is on the ground.

The unit is designed for complete



Clark Climate Controller

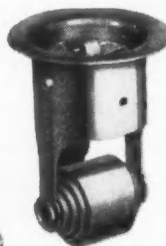
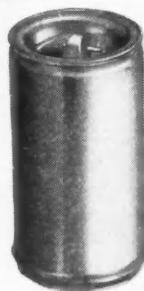
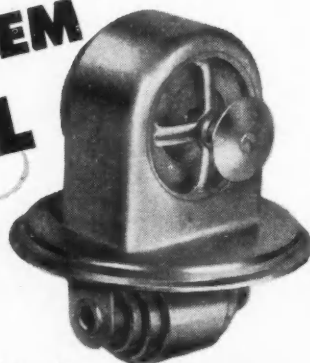


In the new cars now reaching the public, a high level of performance will be maintained by effective control of motor temperatures. This is the function of Dole Thermostats. They assure quick warm-up — with important savings in gas, oil and motor wear through reduced crank case dilution.

DOLE Thermostats

In a Range of Types for Every Car

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mobility and requires no outside source of power or ice, or cooling medium other than included in the self contained unit. It is designed to cool, dehumidify, filter and circulate air during the summer season—or to heat, filter and circulate air during the winter season. Conditioned air is distributed to the interior of the plane through the medium of the existing duct system of the plane. Thermostatic control of cabin temperature is automatic.

When needed, the Clark Climate Controller can be utilized to pre-heat airplane engines, automotive equipment, or can be used for any emergency heating or cooling problem.

(Turn to page 74, please)

Goodyear Airplane Brake



Because of its open construction, this new single-disc airplane brake developed by the Aviation Products Division of the Goodyear Tire and Rubber Co., Akron, Ohio, is said to dissipate heat rapidly. In addition, the single-disc brake adjusts itself automatically, eliminating any need for periodic checking. Goodyear now is producing the brake for all sizes of land planes.

How HYCAR beat a skin game

IN this New England leather factory they boil the hides in cleaning fluid, then flatten them by running them through rolls like the one in the picture. They used to use natural rubber rolls, but they couldn't stand the hot fluid (it's something like kerosene) and lasted only four months, even with frequent grinding to keep the surface firm. Rolls made from one oil-resistant synthetic rubber did a little better—they lasted a year, then became soft and worthless.

Then a roll made from HYCAR was tried. The one you see in the picture has been in use for two years—*six times as long as previous rolls*—and it's still in perfect shape—good for more years of service—thanks to HYCAR's truly superb oil resistance.

Oil resistance is only one of HYCAR's unusual properties, however. Read the list in the box at the right and you'll get a better idea of HYCAR's versatility. You'll understand, too, why parts made from HYCAR are used in every industry where service requirements demand a material that has these unique properties; as grommets and seals of all kinds,



Hycar Roll by Tyer Rubber Co.

hose, vibration dampeners, and scores of other applications where dependability and long life are essential.

We suggest that you ask your supplier for parts made from HYCAR for test in your own applications—severe or routine. You'll find that it pays to use HYCAR for long-time dependable performance. HYCAR synthetic rubber is manufactured by B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio. For more information please write Department HH-7.

CHECK THESE SUPERIOR FEATURES OF HYCAR

1. **EXTREME OIL RESISTANCE**—insuring dimensional stability of parts.
2. **HIGH TEMPERATURE RESISTANCE**—up to 250° F. dry heat; up to 300° F. hot oil.
3. **ABRASION RESISTANCE**—50% greater than natural rubber.
4. **MINIMUM COLD FLOW**—even at elevated temperatures.
5. **LOW TEMPERATURE FLEXIBILITY**—down to -65° F.
6. **LIGHT WEIGHT**—15% to 25% lighter than many other synthetic rubbers.
7. **AGE RESISTANCE**—exceptionally resistant to checking or cracking from oxidation.
8. **HARDNESS RANGE**—compounds can be varied from extremely soft to bone hard.
9. **NON-ADHERENT TO METAL**—compounds will not adhere to metals even after prolonged contact under pressure. (Metal adhesions can be readily obtained when desired.)

Hycar

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LARGEST PRIVATELY PRODUCED BUTADIENE TYPE

Synthetic Rubber

B. F. Goodrich Chemical Company

A DIVISION OF
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AUTOMATIC SCREW MACHINES

Perform Best with

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ThredKut ThredKut 99 SPEEDKUT SUPERKool Base

STUART engineers have seen it many times—the almost startling improvement in performance when one of those four Stuart products is substituted for an ordinary "getting-by" oil on a screw machine operation. The reasons for the difference are nothing mysterious. Stuart's ThredKut 99, ThredKut, SuperKool Base Blends and SpeedKut are heavy duty, high anti-weld, high lubricity oils which make improved finish and longer tool life possible—their high quality insures protection for precision machinery. Their use insures optimum production results by increasing the efficiency of automatic precision machines. That is why so many of the largest, oldest, screw machine products plants use Stuart Oils.

Improve the performance of your screw machines with Stuart Oils—start by talking it over with a Stuart sales engineer.

"Cutting Fluids for Better Machining" is a Stuart Oil handbook containing information and data on machining as well as cutting fluids. . . . Available to you upon writing—

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Stuart Oil Engineering Goes With Every Barrel

Dual Remote Control Radio Direction Finder

Fairchild Camera & Instrument Corp., Jamaica, N. Y., is now producing a dual remote control automatic radio direction finder for aircraft, the AN/ARN-6, which differs greatly in size and design from previous automatic models.

Designed completely for four-band operation to cover all normal broadcast transmissions, including those of European and Asiatic stations and marine beacons in the range 100-1750 kc, it is so light in weight (60 lb.) it can be carried in smaller planes.

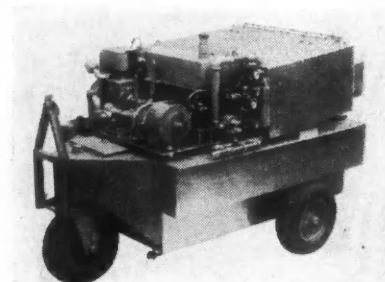
The new band is 100-200 kc. The other three bands are 200-410, 410-850, and 850-1750 kc. In addition to providing additional navigational aid, the new low frequency band is said to reduce difficulty from night and mountain effects, since low frequencies are less subject to those troubles. Mountain effect is a reflection of radio waves which can widen the aural null and cause erratic wavering of needle indications, whereas night effect is a reflection from the Heaviside layer, which also causes a wider null and erratic needle indications on higher frequencies, particularly at sunrise and sunset.

Anti-Icing and Anti-Fogging Glass Developed

A solution to one of the aviation industry's problems—exterior windshield icing and interior fogging—is seen in a development by the Pittsburgh Plate Glass Co., Pittsburgh, Pa. The idea broadly involves the use of a transparent electrically conductive coating, identified by the trade mark NESA, on glass whereby de-icing and de-fogging can be realized by the application of electrical energy.

According to the Pittsburgh Plate
(Turn to page 76, please)

Hilco Portable Filter for Aircraft Engines



The Hilliard Corp., Elmira, N.Y., has brought out this Model RHP-20X Hilco Hyflow portable lube oil filter. It is completely self-contained—no accessory equipment is required. Oil is cleaned by being pumped through a spark-ignited gasoline heater, then through a battery of filter cartridges. A gasoline engine drives the oil pump.

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On the Assembly Line...

**FASTENING JOBS
ARE SIMPLIFIED WITH
EXPLOSIVE
RIVETS**

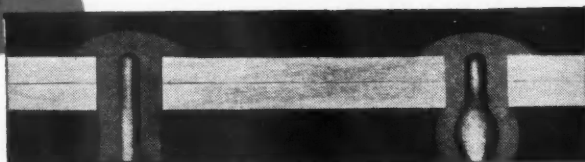
Even tough, troublesome fastening jobs are simplified with Du Pont Explosive Rivets. They're a fast "touch-and-go" method of fastening that gives you a strong, smooth, completely finished job. Ideal on assembly lines.

If you're a production foreman or shop supervisor, write us about your fastening problems. These Rivets may help you clip minutes from many fastening jobs. Get complete information now.

E. I. DU PONT DE NEMOURS & CO. (INC.)

EXPLOSIVES DEPARTMENT

WILMINGTON 98, DELAWARE



The Industrial-Type Explosive Rivet has a straight cavity extending the full length of the shank. When Rivet is fired, shank expands through its entire length. Photo shows cross-section of Rivet before and after expansion.



Assembly line fastening job showing operator inserting Explosive Rivet. Riveting iron will set Rivet securely in less than 2 seconds.



Simultaneously placing and setting Rivet. One operator can set from 15 to 20 per minute. No after-operations necessary. The job is done.

**DU PONT
Explosive Rivets**

A Product of Du Pont Explosives Research

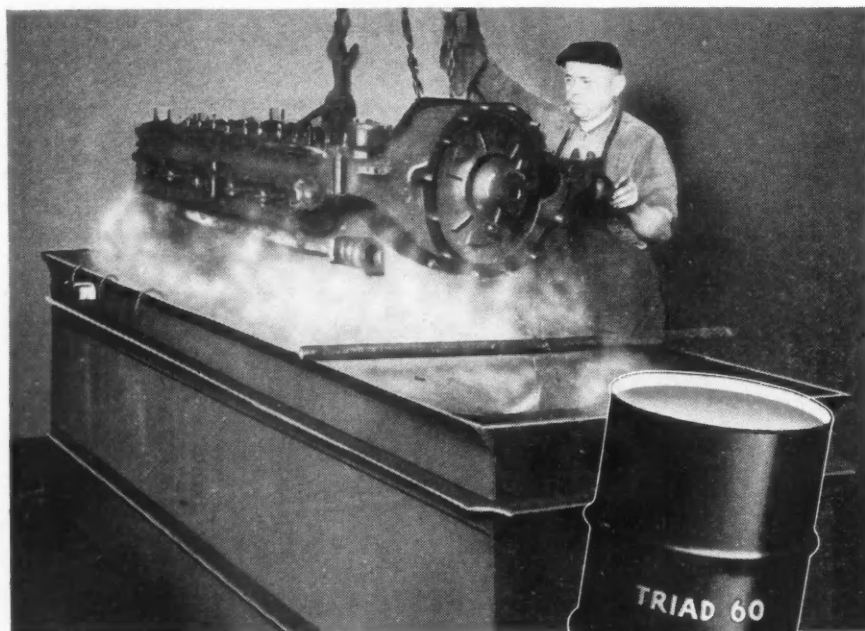


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BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

Glass Co., NESAs is a transparent, durable, electrically conductive coating. When applied to a glass panel its unique properties make it possible to heat the entire area of the panel by the uniform flow of electrical energy across one of the glass surfaces without distorting visibility through the panel and with no serious reduction in the intensity of luminous transmission. In its present stage of development the reflection of a glass surface treated with NESAs is somewhat greater than untreated glass. Also, a NESAs surface produced by the present methods pre-

sents an iridescent appearance by reflected light because of selective reflection of different wave lengths of light and interference effects resulting from slight variations in thickness. However, both the intensity and the color variation of reflected light are minimized by laminating the NESAs surface to another plate of glass with an intermediate bonding layer of vinyl plastic. The unaided eye can detect no color differential in transmitted light and the visual characteristics are approximately the same as untreated glass when employed in vinyl laminates.



ENGINE OVERHAUL *begins with* **CLEANING**

Triad 60, an alkali cleaner compounded by Detrex, is used in hundreds of garages and automobile maintenance shops for economical, speedy stripping of road dirt, oils, and greases prior to engine overhaul.

Engines are torn down; then small, basketed, ferrous-metal parts and entire motor base assemblies are cleaned in Triad 60. High wetting and easy rinsing speed the overall maintenance job. Hand wiping is eliminated.

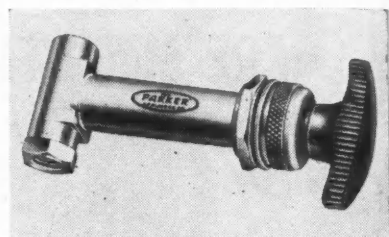
Detrex field representatives can suggest cleaning processes to answer your individual problem. Consult one today.



Lightweight Primer of Simple Construction

A new primer, developed primarily for aircraft use, but suited to tractor and other internal combustion engine use, is announced by the Parker Appliance Co., 17325, Euclid Ave., Cleveland 12, Ohio.

By reason of a new check valve de-



Motarouser primer

sign, the Parker Motarouser is considerably lighter and smaller than conventional models of the same capacity. The positive action of the new check valve also eliminates the necessity of both plug cock shut-off valve and vacuum check valve.

A rubber diaphragm check is used in place of the double spring-loaded ball construction. The diaphragm flexes upon plunger actuation to perform for both intake and injection in the cycle of operation.

Lightweight Automatic Radio Compass

Lear, Inc., 110 N. Ionia Ave., Grand Rapids, Mich., is beginning production on a new lightweight automatic radio compass, which weighs less than 20 lb. when installed. In addition to the weight reduction, a four-in. loop antenna in a plastic bubble, and a special servo unit which rotates the loop, have been developed for it.

Monthly Production of Motor Vehicles in U.S. Plants*

Passenger Cars	
January	58,575
February	47,965
March	90,045
April	150,206
May	152,948
June	142,313
Total—6 months	642,052
Trucks	
January	45,864
February	28,692
March	39,359
April	81,282
May	74,650
June	58,739
Total—6 months	337,586
Total—Cars and Trucks	
January	113,439
February	76,657
March	129,404
April	231,488
May	227,598
June	201,052
Total—6 months	979,638

* Civilian Production Administration.

MACHINABILITY

is the only difference
between **PROFIT** and **LOSS**

When you're producing steel parts on a narrow margin between profit and loss—as most manufacturers are doing today—the MACHINABILITY of the steel bars you use probably determines whether your end result figures are black or red.

No other quality is more important in steel screw stock—for speeds and feeds, production efficiency, rate of output, tool life, unit cost and even the quality of machined surfaces depend upon MACHINABILITY.

That's why so many steel parts users prefer Republic Union Cold Drawn Steels. They know *from experience* that these steel bars not only are unsurpassed in MACHINABILITY, but that they are *uniform* in machining performance as well.

This top MACHINABILITY of Republic Union Cold Drawn Steels is not something which happens accidentally during processing. It results from unequalled machining research both in the laboratory and in parts producers' plants. It results from close control throughout manufacture, all the way from the ore to the finished product.

Would you like to widen your margin between profit and loss in steel parts production? Investigate Republic Union Cold Drawn Steels. Republic metallurgists and engineers are ready to bring you the full story.

REPUBLIC STEEL CORPORATION

Union Drawn Steel Division • Massillon, Ohio

GENERAL OFFICES • CLEVELAND 1, OHIO

Export Department: Chrysler Building, New York 17, N. Y.

Republic

UNION COLD DRAWN STEELS



Free-Machining Bessemer, Open-Hearth and Electric Furnace Steels

Union Cold Drawn Special Sections

Union Cold Drawn and Ground Rounds; Turned and Polished Rounds; and Turned, Ground and Polished Rounds (Union Precision Steels)

Parish Frame Production

(Continued from page 28)

of the treatment. Soft rails—which are not heat-treated—are pickled to remove scale, then are given an alkali wash in a large American Foundry Equipment washing machine. All of the heat-treated rails are shot-blasted to remove scale and provide a fine paint-receptive surface.

Because of the mass and slenderness of the side rails and also because of extreme variations in section size, no practical means has been found to control the warpage of work during the

heat treating cycle. From the know-how developed over a long period of experience, it has been found best to permit the work to deform as it will and then straighten the rails in specially designed power driven machines. Even so, the straightening operation requires great skill and know-how, demands the use of workers with years of training on the job. The rail is put through the machine section by section and is gone over inch by inch until it can pass the straight-edge test for its entire

length in the principal planes.

After straightening, the rails are ready for painting—first a prime coat, then the color coat. Spraying is done in large water-back spray booths similar to those in automotive body shops. Here again is a complication incident to handling an industry-wide business. Each manufacturer has his own specifications for both prime and finish coats and this detail has to be watched in the paint shop.

Of passing interest is the fact that originally the heavy-duty frames were completely assembled by Parish and shipped ready for installation on truck assembly lines. The transportation problem has been so acute in recent years that it has been found more economical to ship frames in a knocked-down condition and then assembled by the truck manufacturer. Consequently, the heavy-duty frame department has no established assembly lines. Nevertheless, on occasion, Parish is required to ship completely assembled truck frames to certain customers. In such cases temporary assembly lines are set up to take care of the specified runs.

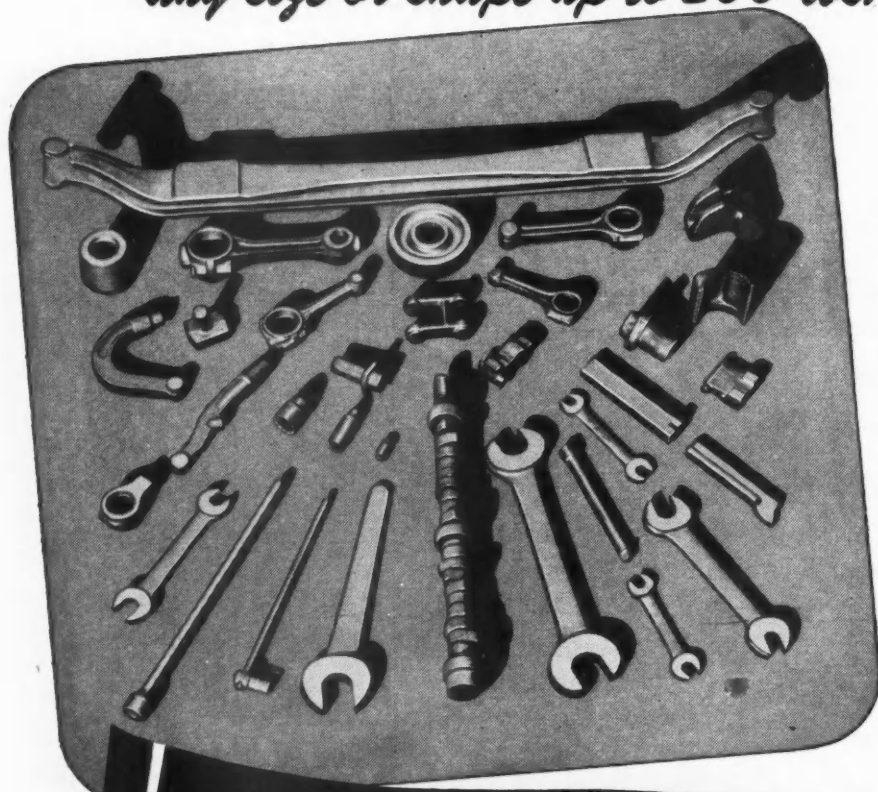
The only example of real mass production in this plant is found in the passenger frame department. Here, in a relatively small area, is housed the operation responsible for the production, currently, of frames for two popular makes of motor cars. In contrast to the activity in other parts of the plant, this represents relatively light-gage metal stamping work. As mentioned earlier, the side rails for these frames are produced in the 2700-ton Clearing press. Meanwhile, the cross-members and components of the X-member are blanked, stamped, perforated, etc., in smaller high-speed presses. Some of the parts are built by flash-welding to other stampings, using the familiar flash welders which were so widely used in the body plants some years ago. Most of the sub-assemblies are made up by arc-welding, one of the major sub-assemblies being the X-member backbone which is integrated by welding while held in steel framing bucks.

Easily the most impressive feature of the department is the relatively short final assembly conveyor line. Assembly starts with the X-member sub-assembly, to which are added the side rails, cross-members and brackets. All fastenings to the side rails are made by cold-riveting, using the popular Hanna hydraulic squeezers—powerful, rapid, and noiseless. The assembly line is literally festooned with these overhead-mounted tools in keeping with a nice sub-division of operations, designed to speed assembly line movement for maximum output.

As the assembled frames near the end of the line they are carefully checked by the inspectors and are ready for transport to the mechanized finishing department. The frames are hooked onto an overhead conveyor and move to the integrated Dry-Sys finish—
(Turn to page 82, please)

Drop Forgings

any size or shape up to 200 lbs.



by **Herbrand**

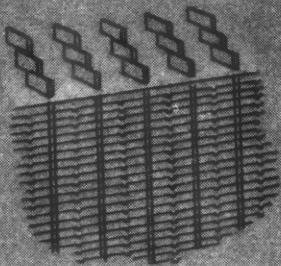
If you require quality drop forgings, in quantities of thousands or millions... Herbrand is an excellent source of supply.

YOUR INQUIRIES ARE SOLICITED

THE HERBRAND CORPORATION • Fremont, Ohio

Drop-Forged Tools Since 1881

Designed FOR EFFICIENT COOLING



The radiator behind the decorative grille has to do an efficient job of cooling the engine. Long radiators have been doing just that for 43 years on a wide variety of automotive vehicles and power units.

LONG MANUFACTURING DIVISION
BORG-WARNER CORPORATION
DETROIT 12, AND WINDSOR



LONG

CLUTCHES • RADIATORS • OIL COOLERS

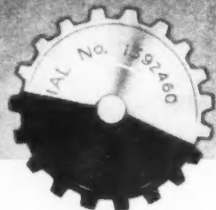
July 15, 1946

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**TRANSPARENT
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CLEARCOAT #626**



Product surface, condition and markings hidden by conventional opaque films but clearly visible through Nox Rust ClearCoat.

The first transparent rust preventive to meet rigid government AXS 673 specifications, Nox Rust ClearCoat No. 626 not only PROTECTS but PRESENTS your products. Surface condition, stencilling and markings that are hidden by conventional coatings can be instantly inspected. After years of research Nox Rust chemists have scored another first.

ClearCoat No. 626 features:
highly transparent . . . complete protection . . . satisfies AXS 673 specifications . . . solvent type . . . easily applied by dip, brush or spray . . . for all metals . . . economical to use . . . adds unusual sales appeal to finished metal parts.

Engineered recommendations based on our years of experience in this field are available for your corrosion problems. Write today for complete details on Nox Rust ClearCoat and other outstanding protective coatings.

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Chemicals for American Industry
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2433 S. HALSTED ST.

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ing unit. The first station is a hot alkali wash to remove dirt and oil. Then the frames are sprayed and hung on a continuous overhead conveyor which carries them through the baking oven. Upon leaving the baking station the overhead conveyor dips down to the level of a table-height gravity roller conveyor to facilitate removal for shipping.

Materials handling equipment of suitable nature is found in every department. Much of the transportation in the heavy-duty frame section is handled by heavy cranes. A large fleet of power-driven industrial trucks—mostly Clark units—is used for departmental hauling, for stacking and tiering.

It may be readily appreciated that an operation of this character requires unusually ample facilities for the making of tools and dies and for the maintenance of such equipment. One is impressed with the enormous tool room found here, augmented since the close of the war program by expanding the tool room into what was once the Parish Arsenal building.

Considering the use of great tonages of alloy steel for heavy-duty frames it is important to note that all steel is controlled by the metallurgical department. Control of specification materials begins right at the steel mill where a sampling is taken of every heat intended for shipment to Parish. This is subjected to a check analysis before the heat is released. Ultimately, when the rolled plate is received at Parish the metallurgical department checks again to assure conformity to specifications but more particularly takes sample coupons for bend tests as an index of ductility and formability.

To supplement this description of the plant given above, a small group of illustrations have been selected to show the nature of the equipment and facilities and to permit the reader to better visualize how the job is done.

Air Briefs

(Continued from page 29)

perature, fuel-flow, a-c remote-indicating pressure gages and turbine temperature. A possible solution to the last is seen in the use of a new chrome-cobalt alloy, which changes color every 25 C. change in temperature up to about 900 C., far above the present operating conditions. By utilizing the new alloy in aircraft gas turbine fabrication, General Electric engineers literally force the turbine to take its own temperature!

Jet Helicopter

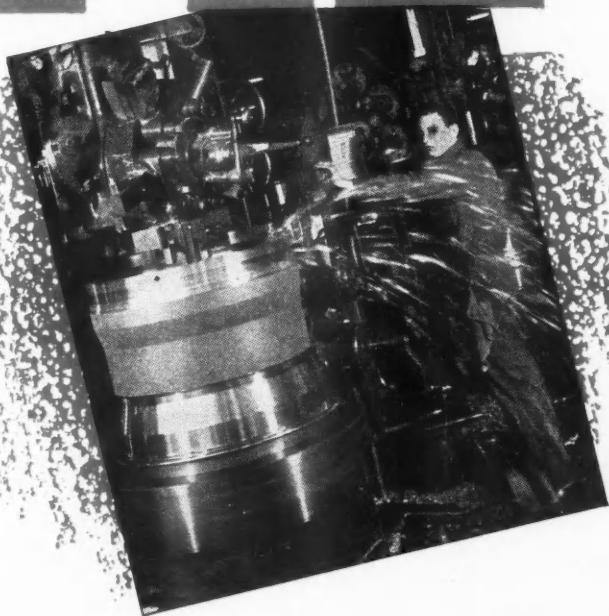
The British Royal Air Force has begun flight tests on a new jet helicopter (Turn to page 84, please)

YOU CAN USE OUR
"KNOW HOW"

IN

DIE CASTING and MACHINING

LIGHT METAL



What do you make or use that can be improved by the introduction of **MAGNESIUM** or **ALUMINUM** in its make-up? Or what production do you now have, requiring die castings or machining of these light metals?

Our "know how" is at your service . . . our engineering and manufacturing experience, from years of being one of the nation's largest workers in light metals. Performance and sales value can be built into light metal products . . . let us work with you in their production.

HAYES INDUSTRIES, INC.

and subsidiary, LITEMETAL DICAST, INC.

JACKSON, MICHIGAN

developed by Weir Aircraft Corp. The design is generally similar to an early Sikorsky model with the exception of the tail anti-torque rotor which is replaced on the British model by a small jet produced by the main rotor engine and ducted to the tail.

Air Show

First industry-wide aircraft exhibition since 1938 scheduled for November 15-24 at Cleveland will be held in the plant formerly occupied by the Fisher Body Division of General Motors Corp. during the war. A second show will be in Los Angeles in April, 1947.

Wright Plane

Orville Wright has denied published reports that he had approved the return of the original Wright Brothers Flier to this country. The fragile, little biplane, first heavier-than-air craft in the world to make a sustained, controlled flight, is now on exhibit at the Science Museum, South Kensington, England where it has been since 1928 following a bitter quarrel between Wright and the Smithsonian Institution in Washington, D. C. Dr. Charles D. Walcott, secretary, had supported the claims of Prof. Langley that his

machine was the first to fly, which has since been proved false.

Ramjet Engine

The Navy has announced the development of a 70-lb ramjet engine, which is capable of speeds up to 1500 mph. The ramjet, developed by Johns Hopkins University Applied Physics Laboratory, has no moving parts and consists only of a hollow tube with fuel supply. It is claimed ideal for guided missiles, which are expendable, because of its enormous power, extreme simplicity and low manufacturing cost. More than 20 universities and industrial firms are now at work on various ramjet projects for the Navy Department.

Jet Bomber

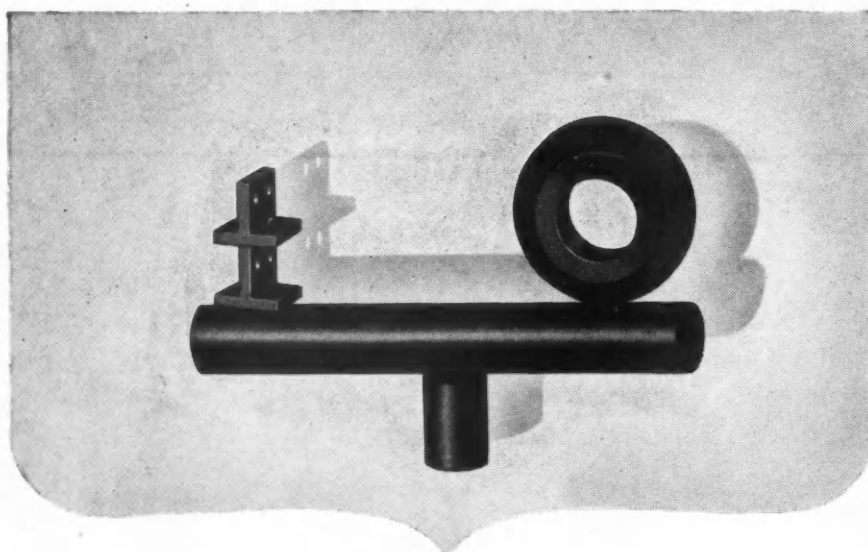
Details of the Douglas XB-43 jet-propelled bomber reveal it as basically and XB-42 *Mixmaster* structure with a change in power plant from the Allison engines of the latter. The two turbo-jet engines are mounted in the fuselage directly behind the pilot with the tail pipe existing at the extreme rear. The empennage has been redesigned and the lower stabilizer omitted. The bomber, first jet-propelled of its type, is now undergoing flight tests at Muroc Army Air Base, California, where speeds of more than 500 mph have been reported.

Saturn Flies

The first flight of the eagerly-awaited Lockheed Saturn feederliner has been made successfully. The 14-passenger design features a high wing and huge, squared vertical fin and rudder. It may be powered by either two Wright Cyclone radials of 900 hp each or two Continental engines of 600 hp each, depending upon the performance and economy desired. The craft weighs 16,000 lb loaded and has a top speed of about 250 mph. Production is geared to start and continue at a one-a-day rate during 1947. Current price is \$130,000 for a single plane with reductions increasing with quantity.

Aircraft Diesel

Proponents of the Diesel engine as an aircraft power plant seem unconquerable after more than 20 years of disappointment in the field. Flight tests are now being carried out on the Thaheld Diesel four-cylinder engine which weighs 235 lbs. and is claimed to have a consumption of only 2.3 gallons per hour. A Stinson 105 light-plane with a 90 mph cruising speed is being used for the tests.



In Balance!

Get a better balance

of desired properties with TAYLOR FIBRE

A weird-looking scale? Yes, but it suggests *balance* . . . a rounding-out of physical and electrical characteristics so that no one property suffers through over-emphasis on another. With Taylor Fibre, you get high dielectric strength, unusual physical stamina, and adaptability to a wide range of production processes.

The T-pieces on the left are cam followers for distributors. The "balance arm" is a thin-walled tube used as a coil form in auto radios. The washer at the right, as well as the small tube pictured as the "fulcrum," are parts of starter motors.

These are but a few samples of what Taylor is doing for automotive and aeronautical engineers. How about *your* problem? Write today, sending sketch or blueprint . . . or outlining desired characteristics . . . and we'll tell you exactly what Taylor Laminated Plastics can do for you.

TAYLOR FIBRE COMPANY

LAMINATED PLASTICS: PHENOL FIBRE • VULCANIZED FIBRE—Sheets, Rods, Tubes, and Fabricated Parts
NORRISTOWN, PENNA. Offices in Principal Cities Pacific Coast Plant: LA VERNE, CAL.

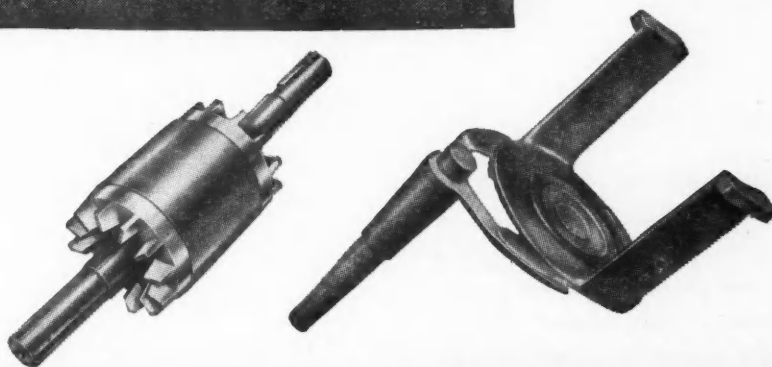
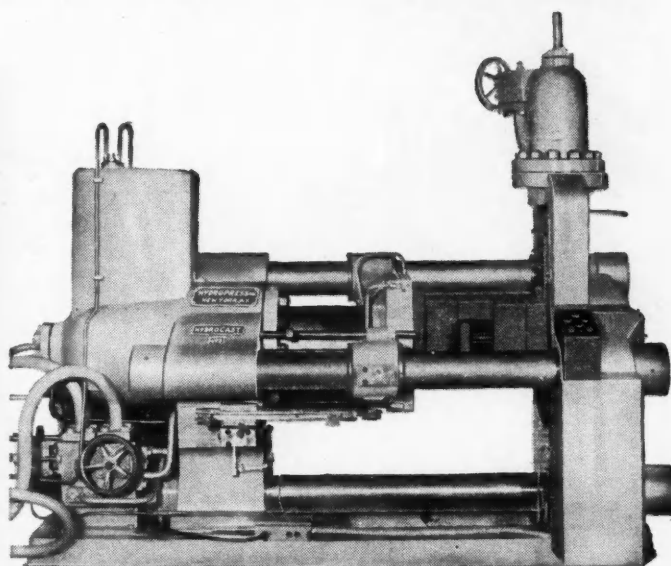
HYDROCAST (TRADE-MARK)

COLD CHAMBER

DIE CASTING MACHINES

DESIGNED TO CAST THE ALLOYS OF COPPER, ALUMINUM,
MAGNESIUM AND ZINC FROM 3 cu. in. TO 300 cu. in.

**FULL-HYDRAULIC
SELF-CONTAINED
SEMI-AUTOMATIC
ELECTRICALLY
CONTROLLED**



LET US KNOW
YOUR INDIVIDUAL
DIE CASTING PROBLEM
WE WILL WORK IT OUT
IN ACCORDANCE WITH
YOUR SPECIAL
REQUIREMENTS
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LITERATURE L-24

HYDROPRESS • INC.

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**HYDRAULIC PRESSES • ROLLING MILLS • PUMPS
ACCUMULATORS • DIE CASTING MACHINES**

566-570 LEXINGTON AVENUE • NEW YORK 22 • N. Y.

New Production Equipment

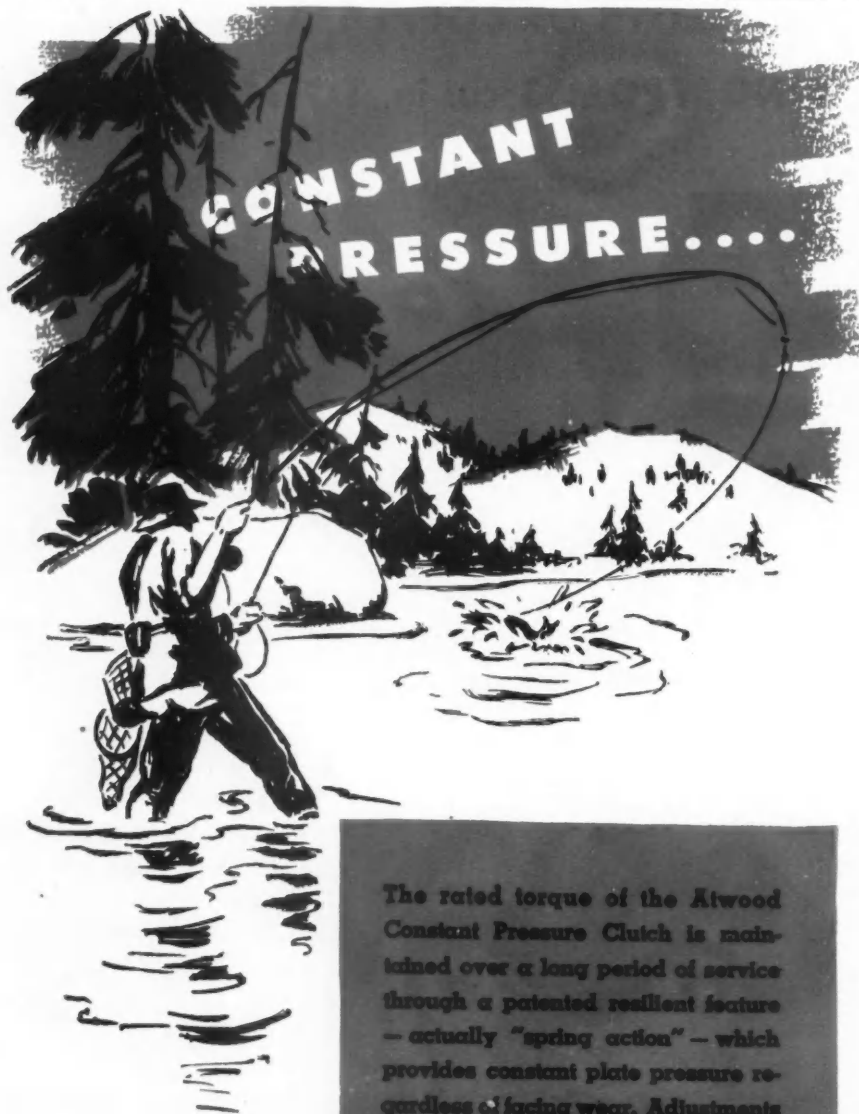
(Continued from page 50)

Each of the two-spindle boring heads is driven by an individual variable-speed d-c motor and each boring spindle is equipped with special clamps to permit boring bars to be exchanged quickly, thus providing adaptability to a wide range of work sizes in diameter as well as in length.

Spindle speed is controlled by rheostat to the d-c motors and is shown on an indicator. After setting, spindle speed, rate of tool feed and depth of cut are automatically maintained, and the use of cemented carbide tools is

said to assure the required accuracy and finish throughout a considerable volume of production without tool adjustment.

YALE & TOWNE MANUFACTURING CO., 4530 Tacony St., Philadelphia 24, Pa., has added a 2-ton model to its line of Midget King electric hoists. Formerly the unit was available only in 1/8, 1/4, 1/2 and 1 ton capacities. The 2-ton Midget King is equipped with a one hp motor. Lifting and lowering action is

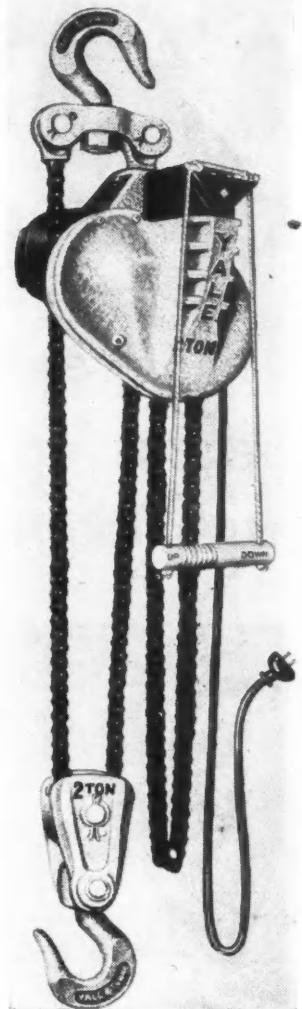


The rated torque of the Atwood Constant Pressure Clutch is maintained over a long period of service through a patented resilient feature — actually "spring action" — which provides constant plate pressure regardless of facing wear. Adjustments are few and far between.



OVER A MILLION ATWOOD CLUTCHES IN SERVICE
***THE ATWOOD CLUTCH COMPANY**
 AUBURN, INDIANA, U. S. A.

*Formerly Auburn Manufacturing Company



Midget King electric hoist

obtained by the one-hand bar-grip control.

To carry the load, an alloy steel roller chain is used. The load hook is of special steel which opens slowly without fracture before any other part of the hoist is strained to the yield point.

Upper and lower limit safety stops prevent overtravel of the hook. The load brake and independently acting motor brake operate whether the power is on or off. Both brakes, all wiring, and the controller are totally enclosed.

The 2-ton Midget King electric hoist is available with hook for stationary use and with a permanently attached trolley for use on an overhead track. Accessories include a chain container for collecting slack chain, eliminating kinking and keeping the chain away from the worker and the load. To provide automatic electric cord support and feed when the Midget King is used on a trolley, a special device is available.

A NEW development in endothermic atmosphere generators is the Hyen hydriding generator, a fully automatic central station unit that can furnish atmosphere for a number of furnaces.
 (Turn to page 88, please)

Let SPEED NUT USERS

tell you why

No. 1 in a series, "The Customer Talks"

**They Changed to
Speed Nuts**

ASSEMBLY ADVANTAGES

Prevent vibration loosening

Protect fragile materials
against damage

Eliminate lock washers

Eliminate handling of
material

Applied faster

Perform multiple functions

Will not "clog" or "freeze"

Reduce assembly costs

Weigh less

Speed Nuts are resilient, yet maintain tension vital to tight joints. They eliminate lock washers, save hours of labor and really hold tight. On the one item of shipping alone, Speed Nuts pay us big dividends in customer satisfaction alone by absorbing vibration and shock, and eliminating the extra labor involved in replacing lost bolts and nuts.

James Mitchell
James Mitchell
President



Stove manufacturers face difficult assembly problems. The severe vibration and shock that stoves are subject to during transportation to the ultimate consumer must be met. Allowance must also be made for expansion and contraction of porcelain enamel parts when the stove is heated up to 500 degrees. The Cleveland Cooperative Stove Company select-

ed Speed Nuts to solve their fastening problems, for Speed Nuts provide a spring tension lock that holds tight under severe vibration and yet is sufficiently resilient to prevent damage to porcelain enamel surfaces. In addition, Speed Nuts eliminate lock washers, reduce assembly time and weigh less.

Speed Nuts will pay you big dividends, too. In writing for samples, please give complete assembly details, as Speed Nuts are made in more than 3000 shapes and sizes.

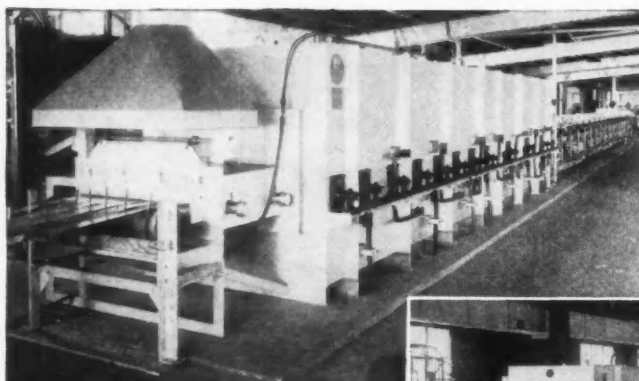
TINNERMAN PRODUCTS, INC. • 2059 FULTON ROAD, CLEVELAND 13, OHIO

In Canada: Wallace Barnes Co., Ltd., Hamilton, Ontario
In England: Simmonds Aerocessories, Ltd., London

In France: Aerocessories Simmonds, S. A., Paris
In Australia: Simmonds Aerocessories, Pty. Ltd., Melbourne

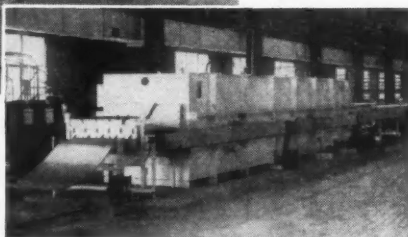
Speed Nuts 
PATENTED *Trade Mark Reg. U. S. Pat. Off.

FY A'S TRUST THING IN FASTENING'S



This EF installation is bright annealing six parallel strands of strip. Handles any width up to 30 inches.

This EF installation handles strip in widths up to 36 inches. Wider sizes available.



EF Furnaces

*Bright Annealing
and Normalizing Strip—
Continuously*

For Hot or Cold Rolled; High or Low Carbon; or Stainless

Sizes to Handle **1,000 to 28,000 lbs. per hour**

Quicker deliveries, shorter annealing time and less material in process . . .

Continuous operation, uniformity of finish and anneal . . .

Elimination of pickling, moderate floor space requirements and low operating costs.

These are some of the advantages of EF continuous controlled atmosphere furnaces for bright annealing and normalizing strip.

The finish and anneal are uniform as the material is annealed in strip form, and every linear foot is therefore subjected to exactly the same temperature and conditions regardless of the tonnage.

The anneal is secured in a few minutes in place of hours . . . requiring less material in process.

Can be built in sizes to handle any width or tonnage required.



We are in position to design and build the size and type best adapted to your particular plant product, and production requirements.

We solicit your inquiries covering production furnaces for handling strip or other products in any size or shape . . . no job is too large or too unusual.

The Electric Furnace Co., Salem, Ohio

Gas Fired, Oil Fired and Electric Furnaces—For Any Process, Product or Production

Production Furnaces

For Handling Products in
Any Size or Shape

FURNACES

For Every Heating and Heat Treating Process

Aluminum Brazing

Annealing

Billet Heating

Bright Annealing

Bright Hardening

Copper Brazing

Controlled Atmosphere

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Drawing

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Hardening

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We Build the Furnace to Fit Your Job

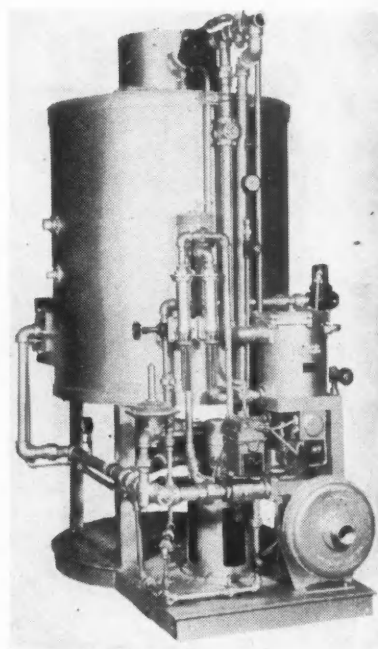
THE ELECTRIC FURNACE CO.

SALEM, OHIO

For Production Furnaces, For
Any Process or Production, Consult

The Electric Furnace Co., Salem, Ohio

No Job Is Too Large or Too Unusual

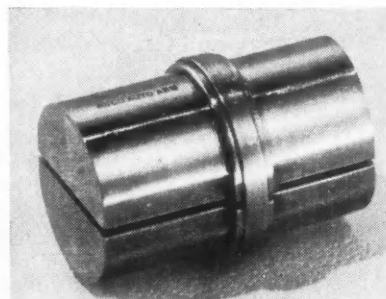


Hyen hydriding generator

This new unit, engineered and manufactured by Lindberg Engineering Co., 2444 W. Hubbard St., Chicago 12, Ill., is said to produce a clean, dry gas for hardening, brazing, and sintering all medium and high carbon steels without carburization. Gas analysis is carbon dioxide—0.0 per cent; carbon monoxide—21.0 per cent; hydrogen—40.0 per cent; methane—1.0 per cent; nitrogen—38.0 per cent; oxygen—0.0 per cent; and dew point—20 F.

The Hyen is fully automatic. After lighting the pilot, all phases of operation are controlled by means of push buttons. The generator requires no charcoal, and does not have to be burned out periodically to remove soot. It operates by city gas, natural, propane, or butane for both atmosphere and heating, and is built in four standard sizes—500, 750, 1500, and 2500 CFH.

THE ASCO CORP., 874 E. 140th St., Cleveland, Ohio, offers a new production tool for speeding certain machining processes. This tool, called the Asco "Auto-Arb," is an expanding arbor for use on secondary operations where the work-piece is held by its inside diameter. Its design permits (Turn to page 90, please)



Asco Auto-Arb



it's money

in your pocket

to know—

the best brake is **AIR!**



It's actually money in your pocket to learn about Bendix-Westinghouse Air Brakes, for three good reasons. First, they give your drivers' loads and lives the protection of the safest brakes that money can buy—and certainly there's no sounder investment than safety. Second, they make your drivers' jobs easier—and with less driver fatigue, trips are completely on schedule. Third—and extremely important—they keep your trucks where they belong—on the road

making money. It's literally true that Bendix-Westinghouse Air Brakes quickly pay for themselves—and then go on to give long years of faithful service, often outlasting the truck itself. Your Bendix-Westinghouse distributor can show you how inexpensive it is to modernize your present equipment or will assist in selecting, for new equipment, the right type Air Brake for the specific job.

BENDIX-WESTINGHOUSE AUTOMOTIVE AIR BRAKE COMPANY
ELYRIA, OHIO

Bendix-Westinghouse
AUTOMOTIVE AIR BRAKES

**WORLD STANDARD
OF SAFETY**

chucking and unchucking work-pieces without stopping the spindle when used on a screw machine or lathe with standard collet. It is said to expand accurately, maintaining perfect concentricity with the collet. It can also be used on drill presses or milling machines with collet devices.

"Auto-Arb" is made in sizes from $\frac{3}{8}$ in. to 1 in., at $\frac{1}{64}$ in. intervals. Entire range is accommodated with three collet sizes. Larger sizes may be made to special order.

THE MABOR Co., Walnut St., Clark Township, N. J., is introducing a production degreasing machine that

uses a liquid jacket heating system which operates at atmospheric pressure. No coil or heater is located in the bottom of the tank.

The new Mabor degreaser can be heated with high pressure steam without the use of a pressure-reducing valve, or with gas or electricity without any possibility of overheating the solvent at any time. The degreaser is also equipped with an automatic control system that pre-heats the circulating water above the dew point. An automatic oil and grease skimming device is standard equipment and has been so engineered as to require no attention.

a name identified with good MOTOR performance



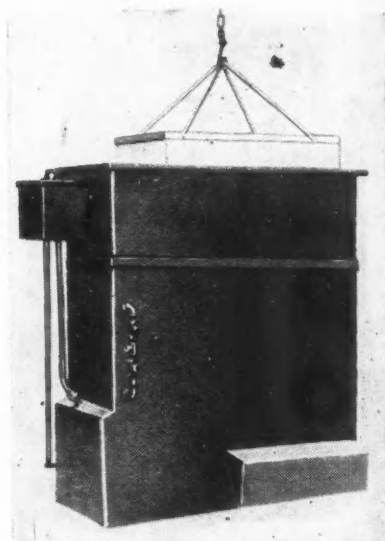
Specially designed for each particular application and with quality and dependability built into every part, Lamb Electric Motors have established a reputation for long, trouble-free performance.

Contributing importantly to this good performance is our experience gained in 31 years of designing and building small motors for over three thousand special applications.

THE LAMB ELECTRIC CO.
KENT, OHIO

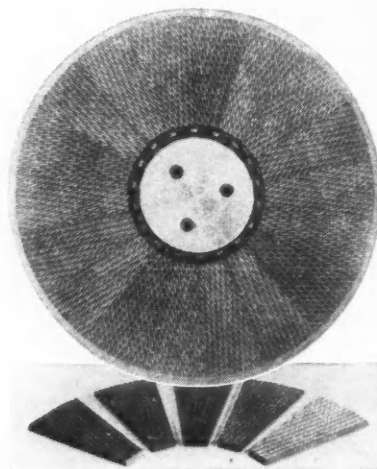



FORMERLY *General Electric* **SPECIAL APPLICATION FRACTIONAL HORSEPOWER MOTORS**



Mabor degreasing machine

The Mabor degreaser is equipped with all safety controls, and is built in many standard sizes. It may be custom built for vapor, vapor spray, liquid vapor, and liquid liquid vapor. In addition, conveyORIZED machines also can be built for any kind of cleaning problem in any size.



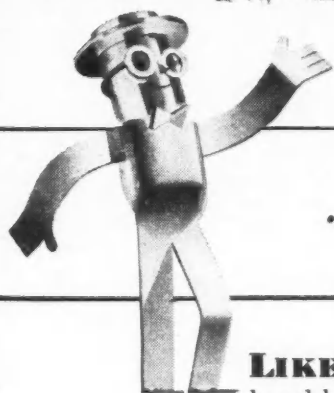
Kennametal disk file

KENNAMETAL INC., Latrobe, Pa. is now producing a disk file for use on light alloys, die castings, and plastics. This new tool is designed to facilitate the facing of rough castings, and removing of unwanted projections, such as flash or draft, gates, risers, etc.

It consists of double-cut segments of solid Kennametal, dovetail-wedged into a 12-in. diameter steel body which can be supported and driven by any suitable means. The teeth are formed and positioned so that the material is sheared off in clean-cut chips.

The file body may be attached direct to a rotating member of the driving machine, by socket head cap screws, if it has a suitable supporting flange and
(Turn to page 92, please)

Frontiersman ...1946!



...and we at Solar are all for you.

LIKE the Frontiersman, who followed his dream to carve his own place from the wilderness, the returned G.I. depends today upon the spirit of America — Free Enterprise — for his opportunity.

Solar wishes success to every single one, because Solar, too, is a product of the American Way... born and raised under the protection of the Four Freedoms. America has always granted each individual the right to rise above a given station... to follow his vision... to satisfy his own conception of the word, Freedom. The fundamental principles on which this country rests make this possible.

The G.I. of today, starting afresh, has his choice — to enter business for himself — or to join an established organization. If he elects to start his own business, then he must work hard to make his venture a success... he must undertake the responsibility of ownership and authority... he must assume the risk of losing his investment.

If he decides to join an organization that started as a small business, like our own company, an organization that has conquered many problems to become a leader in its field, then he must be willing to assume the great responsibility of becoming a member of a team... an individual working in harmony with other individuals toward a common goal.

The important point is that he can *make his own decision*. Americans have always had this opportunity... and Solar believes, with other Americans, that our country will continue to provide a framework of opportunity for all free men.

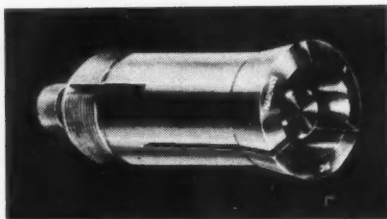
SOLAR **STAINLESS PRODUCTS**

SOLAR AIRCRAFT COMPANY • SAN DIEGO 12, CALIFORNIA
DES MOINES 5, IOWA • 60 E. 42ND STREET, NEW YORK 17, N. Y.

centering stud. If such means are not available, a flanged adaptor may be made.

HARDINGE BROTHERS, INC., Elmira, N. Y., announce their Hardinge universal lathe collet stop for second operation work. The collet stop will convert any standard 1 in. capacity lathe collet into a solid stop or spring ejector stop collet without alteration of the standard collet. The stop is placed in the rear of the collet and securely anchored in place by the movement of a single locking bolt.

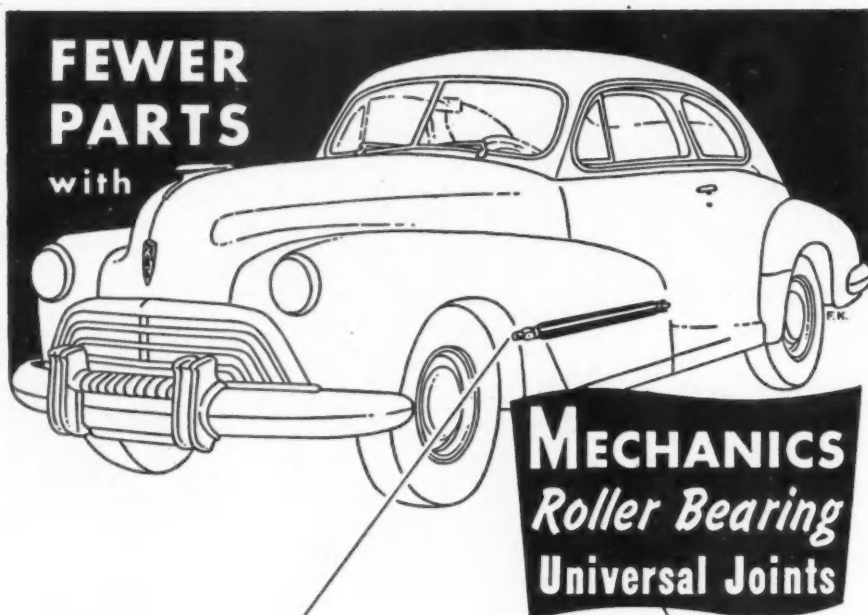
The universal collet stop with spring ejector stop in place will automatically eject parts from a collet when the



Collet equipped with Hardinge universal lathe collet stop

collet is open.

The set consists of the collet stop body, one large and one small solid stop insert, one large and one small spring ejector insert, and necessary wrenches.



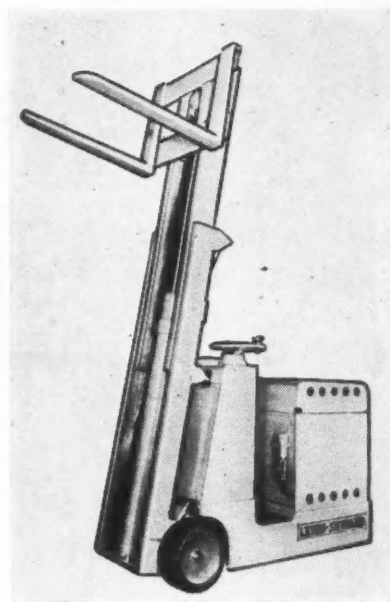
The slip-on-the-transmission-shaft feature permits the spline, on this **MECHANICS** Roller Bearing **UNIVERSAL JOINTS** and tubular shaft assembly, to be lubricated by the lubricant in the transmission — eliminating the conventional reservoir and stub shaft. Let our engineers show you how this and other **MECHANICS** features will help you reduce weight and costs in your new models.



MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner

2020 Harrison Avenue, Rockford, Ill. Detroit Office, 7-234 G. M. Bldg.

CONSERVATION of aisle width is claimed for the 4000-lb capacity electric power fork truck produced by Lewis-Shepard Products, Inc., 222 Wal-St., Watertown, Mass. Using a 48-in. fork and carrying a 48-in. load, this truck will enter an aisle 12 ft wide and, in one continuous forward travel of the truck, make a single right angle



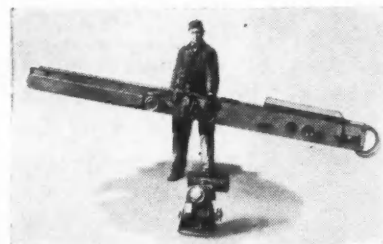
Lewis-Shepard electric power fork truck

turn and right angle stack, with no backing or filling.

The three features of limited overall length, short turning radius, and low center of gravity provide maximum maneuverability under all conditions. In addition to its minimum overall length and short turning radius, this truck is said to have inherent stability when making abrupt turns and when elevating or lowering a load.

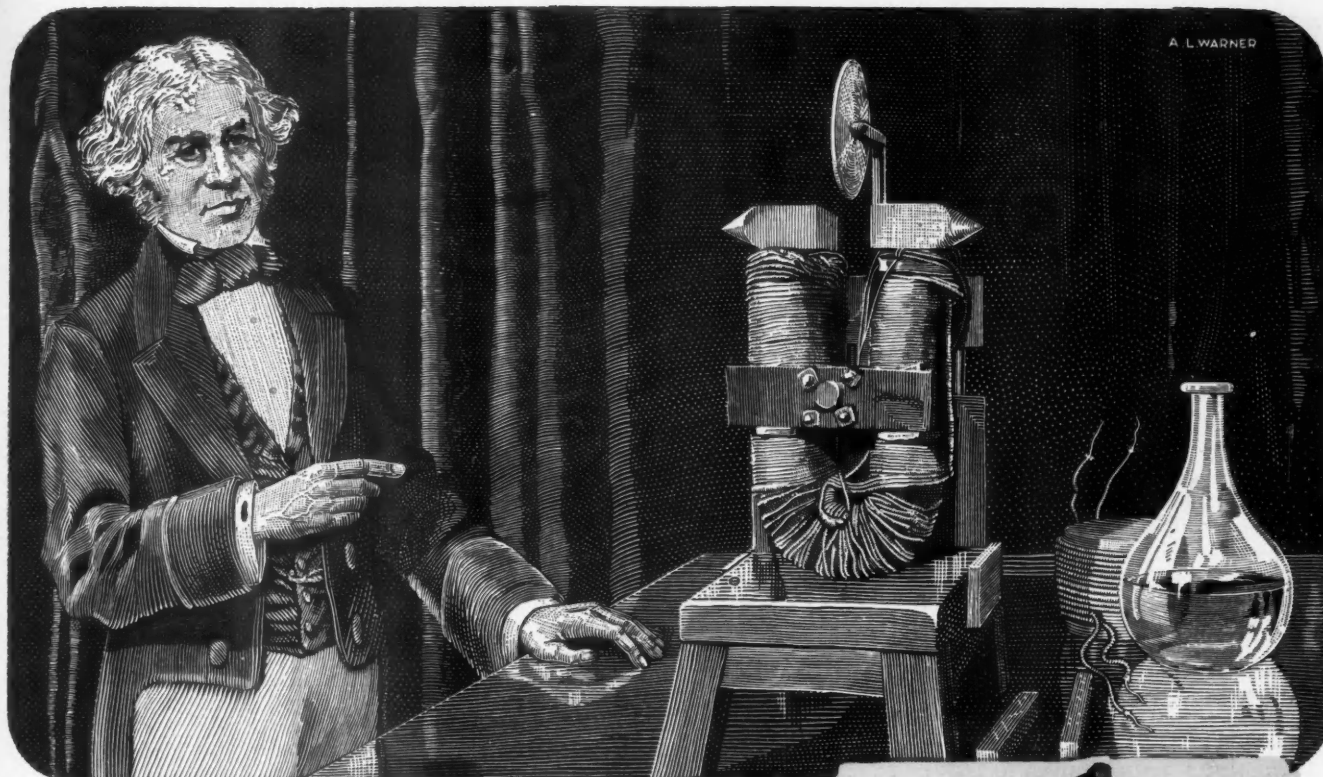
A NEW lightweight portable conveyor for industry, called the Tote-All Zephyr, has been announced by Material Movement Industries, 310 S. Michigan Ave., Chicago 4, Ill. The 12 ft model weighs only 135 lb without motor. The Tote-All Zephyr is made of alloy steel and is corrosion and

(Turn to page 94, please)



Tote-All Zephyr

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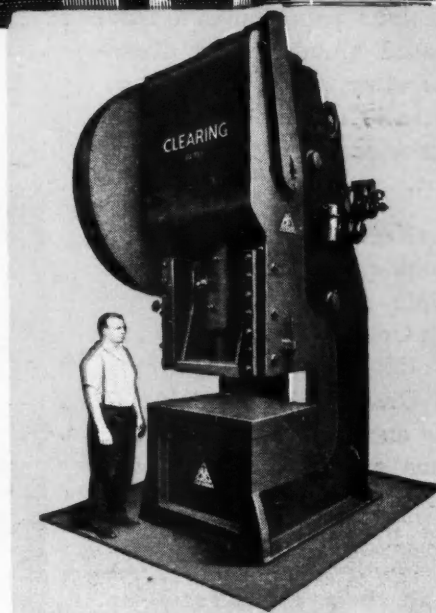


and then the door is open . . .

Men of science have a quiet way of doing things. In pursuing the secrets of nature, there comes a moment, every now and then, when a new door is suddenly opened. In 1831, for example, Michael Faraday calmly presented to his audience his newest discovery . . . a mechanical means of producing electricity. The magnitude of his work remained unrealized until later men, using Faraday's principles, produced the dynamo and the electric motor.

Like science, industry advances quietly but surely. The newer principles of today become the accepted practices of tomorrow. In metalworking, new and better materials and methods are in a state of continuous adoption by industry. A review of only the last ten years makes this evident. In that important phase of metalworking where the forming of metals with presses is involved, Clearing has provided many outstanding machines. In the future, whatever industry's requirements, Clearing will continue to offer its facilities wherever presses can be the answer to a problem in production.

CLEARING MACHINE CORPORATION
6499 West 65th Street Chicago 38, Illinois



A Clearing Press For Fast Work

Illustrated is a 160-ton capacity Gap Frame Press used in the precision production of electric motor laminations. Unusual in design, this Clearing mechanical press operates at 40 strokes per minute. Press assembly includes a crossbar knockout in the slide and a 25-ton Die Cushion.

Clearing mechanical and hydraulic Presses are available in any capacity, type, or dimensional size work may require. You are invited to check with Clearing in any production problem where presses might be involved.

CLEARING MECHANICAL AND HYDRAULIC PRESSES

FOR DRAWING • BLANKING • FORMING • FORGING

Engineered for the Job



Simple Oakite Process

For
Tenacious

PAINT ADHESION on ALUMINUM

It goes without saying that a tenacious paint finish on degreased aluminum or aluminum alloy parts depends importantly on the efficiency of the surface conditioning treatment.

An effective spray or dip surface-preparation method is a simple chemical treatment with Oakite Compound No. 36. A mildly acidic, liquid material Oakite Compound No. 36 puts an etch on surfaces and forms a thin inert adherent film of phosphate which not only provides an ideal base for tenacious paint grippage but also helps retard corrosion.

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CLEANING

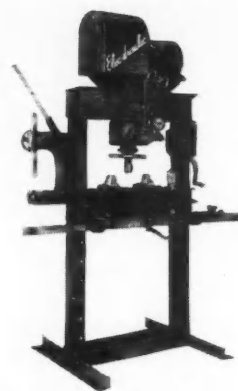
MATERIALS • METHODS • SERVICE

abrasion resistant. At the present time, two lengths are available—12 ft and 16 ft. Both models have an 8-in. belt. Power is furnished by a gasoline engine which is mounted above the conveyor. Engine mounting is adjustable to keep engine level at all conveyor positions. Conveyor may also be furnished with an electric motor for use when electricity is available, or it may be purchased without power unit if desired.

AN ELECTRICALLY operated hydraulic press, called the "Elec-draulic" press, has just been added to the line of Dake Engine Co., Grand Haven, Mich. This press is supplied in 50- and 75-ton capacities, with all pressures controlled by a fingertip control and release valve. No hand pumping is required.

Features of the Elec-draulic press are its variable ramspeed—from zero to six in. per minute—and its movable workhead, which is easily moved to any point along top channels for off-center work. The press is said to be particularly applicable to production-type use, and any desired pressure can be obtained instantly from the constant-running motor. Safety is assured by a dump valve which protects the press against overload.

The frame is constructed of arc-welded steel, reinforced throughout.



Dake Elec-draulic press

Press table height is changed by means of a hoisting crank, and use of the press is speeded by quick-action auxiliary ram returned on release of the pressure valve.

AN AUTOMATIC air valve built to speed up air cylinder travel is now being delivered by Bryant Products Co., Jackson, Mich.

This valve lets the air into the cylinder, then when the three way valve is operated it automatically opens a part at the cylinder for exhaust. It

(Turn to page 96, please)

a Combination hard to beat!

Two completely equipped spring plants, with engineering, production, heat-treating and testing facilities for any size of order—large or small. It's the kind of spring service you'll like.

BARNES-GIBSON-RAYMOND

SPRINGS
Wire Forms
Small Stampings

TWO PLANTS FOR SPRING SERVICE

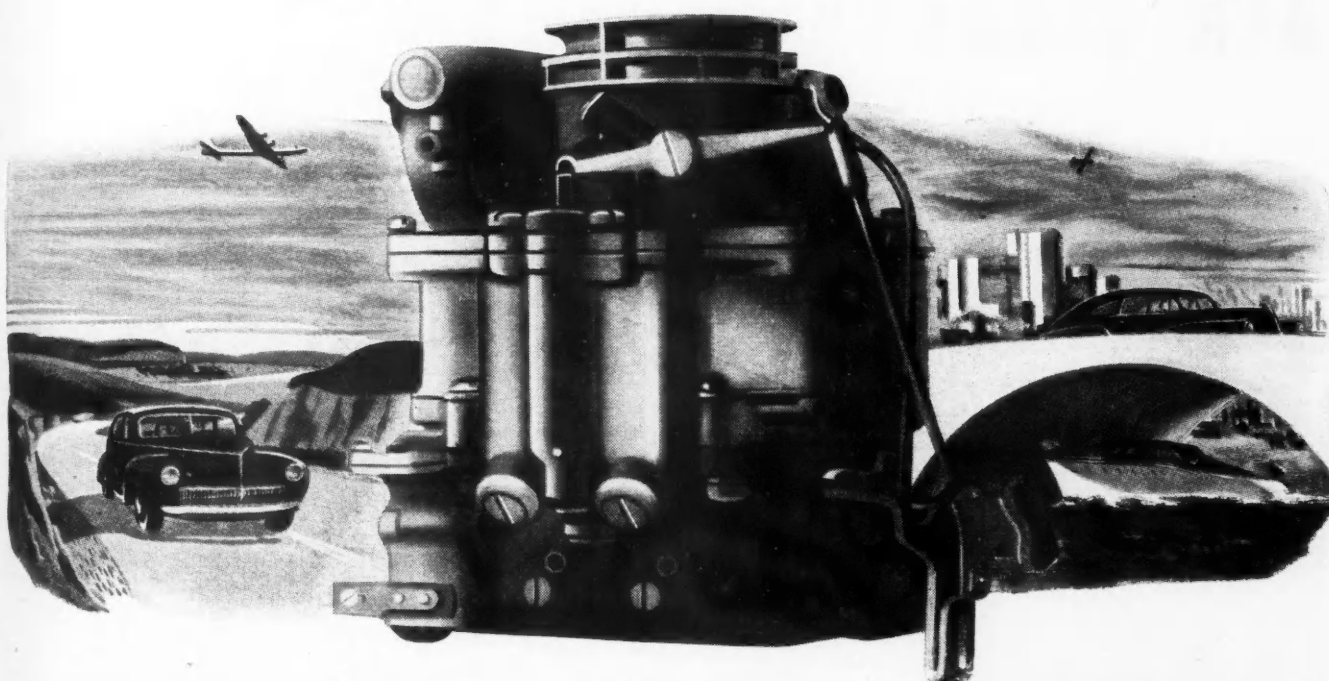
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DIVISION OF ASSOCIATED SPRING CORPORATION

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for
reliable carburetion

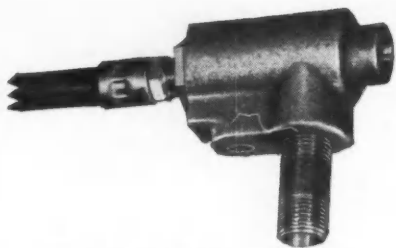
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July 15, 1946

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Bryant automatic air valve

way and one automatic valve is used. On a double acting cylinder with a four-way valve, two automatic valves are used.

These valves are made to go with

the operating valve. If the operating valve is 1/4-in. pipe size, the automatic valve is tapped 1/4-in. pipe on the end and is tapped 3/8-in. pipe to go on the cylinder at the side, etc.

Low Priced Car Economics

(Continued from page 19)

is said to speed up cylinders from 50 per cent to 200 per cent, depending on how far the operating valve is from the cylinder. On a spring return cylinder the operating valve is a three-

differential was not enough. The current problem of designing a full-sized car in the former low price field is illustrated, by a price analysis. Be-

fore the war factory delivered prices of cars in the low price field averaged about 25 cents per lb. Now the average figure is 35 cents per lb. A post-war car selling at \$750 would, at the same price per lb, have to weigh 960 lb less than the prewar car selling for the same figure.

Ford and Chevrolet are the only two major companies to announce plans for a definite lightweight, low-priced automobile. Chevrolet has established a Light Car Division under the jurisdiction of Nicholas Dreystadt, general manager of Chevrolet. The car will be sold through the regular Chevrolet sales organization, but other operations will be entirely independent. Manufacturing will be centered in two new plants near Cleveland to be built as soon as Government regulations will permit. One will have about one million sq ft of floor space, and will produce engines, axles, transmissions, and other components. A second plant will include sheet metal, body and final car assembly. The inclusion of body-building facilities in the Light Car Division represents an interesting departure from General Motors precedent, since bodies for other divisions are produced by the Fisher Body Division. Apparently, the decision rests on the assumption that the division can make the bodies at lower cost than it can buy them from Fisher. Production of the new car is not expected to get started until late in 1947.

Ford also has formed a special division for manufacture of a lightweight car. It is understood that sales will be made through Ford dealers. Henry Ford II, said a few weeks ago that the new car would be presented to the public following introduction of the regular line of postwar Fords, sometime after next January. Additional manufacturing facilities are being sought, and it is thought that possibly the purchase of the aircraft building at the Rouge plant, for which the company has made a bid, would provide the necessary factory space. As to its price, he said that it probably would be about 25 per cent under the regular Ford line. One company spokesman points out that it would have to be at least that much under the regular lines in order to make it attractive to the buyer.

While Chrysler has not yet indicated definitely that it will enter the field with a competitive car, K. T. (Turn to page 98, please)

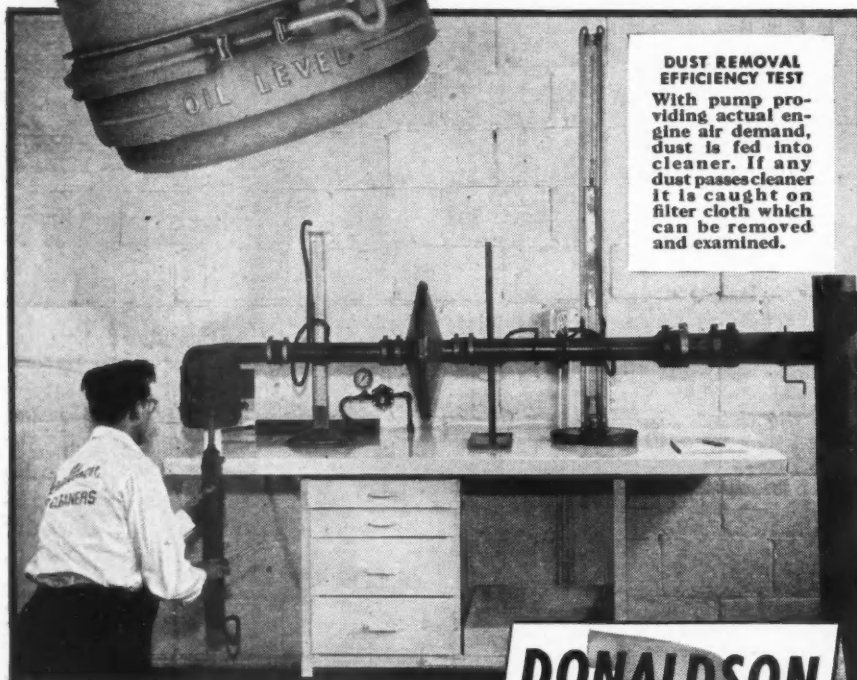
HOW WELL SHOULD AN AIR CLEANER CLEAN?



Dust and dirt inside an engine, grind like emery between moving parts. To prevent this destructive wear, air cleaners must be as close to 100% efficient as skilled engineering can make them.

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When the balance tips this way.....

Reduce Die Costs with these

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Chromium type

HOT WORK STEELS

JESSOP JJ

Highest hardness and greatest hardness penetration of the group. Has very high wear resistance and non-sinking properties. Excellent for operations involving compressive actions.

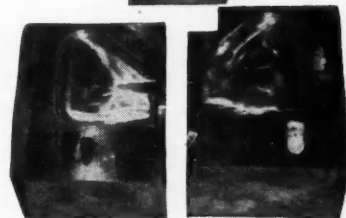
JESSOP J

Intermediate between JJ and Dica B in wear resistance, toughness, and hardness penetration. Recommended as a general purpose hot work steel where tungsten types are not feasible.

DICA B

Greatest toughness of the group. Retains its hardness at temperatures up to 1050°F. Does not scale excessively when air hardened and has practically no size change from heat treating.

Padding die and punch
for cultivator bracket;
made from Jessop's DICA
B hot work steel.



In many hot work applications, the cost of the die steel is of greater importance than high heat resistance. This is particularly true where dies can be water cooled. To meet this requirement Jessop produces three chromium type hot work die steels: JJ, J, and Dica B. We will gladly recommend the type best suited to your requirements. Literature on request.

Jessop also makes 2B tungsten type hot work steel for use where production is more important than initial die cost. Write for complete information.

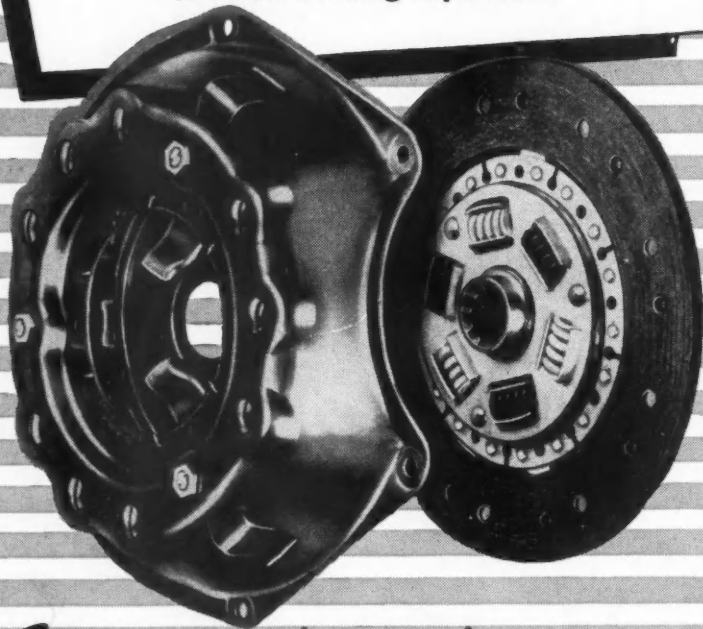


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For that vital spot where Power takes hold of the load!

**BORG & BECK DIVISION
BORG-WARNER CORPORATION
CHICAGO, ILLINOIS**



Keller, president, said a few weeks ago that if the market exists and if other companies have a low-priced car, Chrysler will be ready with something competitive. It also is reported that some of the independents have lower-priced designs in the development stage. Willys-Overland Motors, Inc., long a proponent of a small, lightweight, economical car, will be in the field sometime next year. Details have not yet been announced, but its new model is known to have a six-cylinder engine and other improvements. What the manufacturers will offer in the way of lightweight lower-priced models is of paramount interest. The volume potential of an acceptable car in reach of millions of families would have a significant influence on the future of the industry.

Salt Bath for Heat Treating

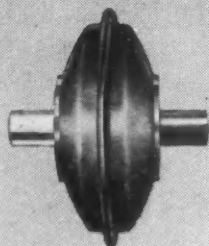
(Continued from page 39)

introduced by the parts themselves. It always presents a clean surface and quenches very quietly. Due to its mobility there is very little drag out and the salt that does stick to the parts is easily removed. The cost of the salt itself is far below that of the other heat treating salts. All in all, from the standpoint of ease of operation, safety and cost, pure sodium carbonate is by far the best heat treating medium for 18-8 stainless steel that has been tested in the Ryan Experimental Laboratory.

The tabulation of results on page ?? may help to compare the properties of the various salts. Each one is rated A, B, C or D according to our opinion of the desirability of its behavior. Our opinion is based on large scale production conditions where it is necessary to heat treat 18-8 stainless steel parts for short periods.

Lovejoy Takes Over Ideal Transmissions

Lovejoy Flexible Coupling Co., Chicago, Ill., has acquired in entirety, the manufacture and sales of the mechanical power transmission department of Ideal Industries (formerly Ideal Commutator Dresser Co.) of Sycamore, Ill.



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stallation details today.

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